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MINERAL RESOURCES
OF THE
UNITED STATES
1931

PART I—METALS

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U. S. DEPARTMENT OF COMMERCE
DANIEL C. ROPER, Secretary
BUREAU OF MINES
SCOTT TURNER, Director

MINERAL RESOURCES
OF THE
UNITED STATES
1931

O. E. KIESSLING
Chief Economist, Division of Mineral Statistics

PART I—METALS

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MINERAL RESOURCES OF THE UNITED STATES, 1931—PART I

THE MINERAL RESOURCES OF THE UNITED STATES IN 1931 [1]

INTRODUCTION

By O. E. Kiessling

Chief Economist, Division of Mineral Statistics

One of the functions of the United States Bureau of Mines is the annual publication of some 60 printed economic and statistical surveys covering important branches of the mineral industry. These reports, made possible through the cooperation of mineral producers, accurately indicate output, values, distribution, stocks, and other factors of economic interest regarding mineral products. Technological advances in mining or in the preparation of minerals for use are noted with interest, but they are viewed chiefly from the standpoint of their actual or potential economic implications. The studies are organized principally on a commodity basis, and an individual chapter usually covers a single mineral or a group of related mineral products. The commodity reports, however, are supplemented by 15 additional State and district mining reviews that analyze carefully important mining developments in areas throughout the United States producing gold, silver, copper, lead, and zinc.

This report, the forty-ninth of an annual series, is published in two parts. Part I contains a general summary of all mineral products, the prefatory note to the chapters on gold, silver, copper, lead, and zinc giving average prices at which values of the metals are calculated, and 37 chapters of which 15 are State or regional reports relating to gold, silver, copper, lead, and zinc mining, 21 are general reports on various metals or metalliferous mineral products, and 1 gives statistics on ore concentration. Part II consists of 29 chapters, each relating to one, or a group, of the nonmetallic mineral products, including the mineral fuels—coal, oil, and gas.

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[1] In Mineral Resources of the United States the use of leaders (----) indicates that so far as the Bureau of Mines has been able to ascertain there was nothing to report. If data are not available, the fact is indicated by a statement to that effect in a footnote. Leaders are also used in footings where it is quite evident that figures in a column are not addable and in other places where entries are not appropriate.

All figures of imports and exports in this report, unless otherwise stated, were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce, having been converted by Mr. Dorsey to the various units of measurement used in this report and arranged by him in their present form. The imports are those for the calendar year unless otherwise stated. Wherever exports are shown, unless otherwise specified, the figures represent domestic products and not foreign minerals reexported, and they also cover calendar years.

SALIENT FEATURES OF 1931 STATISTICS

In 1931, the output and value of nearly all mineral products continued the declines, already general at the end of 1930, at an accelerated pace. Due to falling demand and lower unit prices, the aggregate value of all mineral products in 1931, $3,166,600,000, was the lowest since 1915. As compared with the total for the preceding year, the 1931 value represented a reduction of 34 per cent. This large drop followed a decrease of 19 per cent in the 1930 aggregate value. Compared with 1929, the 1931 total value shows a reduction of 46 per cent, or the largest decline in value for any two consecutive years since the beginning of the statistical record in 1880. Only in two previous instances—1883 and 1884, 1927 and 1928—were declines registered in the total value of mineral products in consecutive years, and these declines were relatively very small. Moreover, although the value of mineral products dropped 41 per cent in the postwar depression year 1921 as compared with 1920, yet the reduced value recorded for 1921 was about a billion dollars more than that reported for 1931.

Except for gold ($49,527,200) and a few mineral products of relatively minor importance representing a combined value in 1931 of only $6,500,000 the downward trend in values was general. Comparisons of the various individual products show only a few scattered departures from this common tendency, and no notable increases were recorded. As in 1930, however, the intensity of the decline was far from uniform, and some branches of the mineral industry suffered much more than others.

Among the metallic products, striking declines in values ranged from 44 to 54 per cent for the important industrial metals, copper, pig iron, lead, silver, and zinc, while the total value of metallic products decreased about 42 per cent from that in 1930. Gold, the standard price of which was not affected by the business depression, again showed an increase in 1931 with a gain of 4.8 per cent in output and value. Relatively large gains in the production of tungsten ores and chromite were accompanied by much smaller proportionate increases in values. The output of mercury and nickel gained about 16 and 21 per cent, respectively, but the total values were less than in the preceding year. These two products were the only ones except for gold, tungsten ores, uranium and vanadium ores, rutile, and chromite (which enjoyed increased total realizations) in the entire metallic group to show value declines of less than 20 per cent.

The mineral fuels as a group decreased about 32 per cent in value of total products. Less bituminous coal was produced in 1931 than in any year since 1909, and the anthracite output was smaller than in any year free from labor difficulties after 1900. Moreover, average unit realizations were slightly lower than in immediately preceding years. Petroleum output decreased for the second consecutive year after steady increases from 1925 to 1929; the output in 1931 dropped only 5 per cent below that in 1930, but the value declined about 49 per cent. Production of natural gas declined about 13 per cent and was accompanied by a sharp decline in value; the output of natural gasoline fell about 17 per cent below that in 1930 and brought barely one-half the total value reported for 1930.

The total value of nonmetallic products (not including fuels) fell 31 per cent. This was considerably less than the decrease recorded for the value of metals but only slightly below that reported for the value of mineral fuels. Except for potassium salts and pumice the declines in values were wide sweeping. A gain in the output of bromine was offset by prices low enough to result in a reduced total value. In spite of road and public-building programs the demand for nonmetallic structural materials declined sharply. As compared with 1930, total values of all the important nonmetallic building materials—stone, gravel, gypsum, lime, cement, asphalt, slate, mineral paints, sand-lime brick, and clay products—decreased 17 to 38 per cent in 1931.

The figures for aggregate value of all minerals, just reviewed, have interest as a partial measure of the mineral industry's annual contribution to the national wealth and as an indicator of the relative importance of specific branches of mining activity. Unless supplemented by a careful study of quantities of the various minerals produced, however, they do not present a complete picture of the year's events, since values seldom rise or fall in exact accord with fluctuations in output. In 1931, for example, declines in production generally were accompanied by larger proportionate decreases in values. Total values declined less than output for only a few products (emery, garnet, gypsum, oilstones, phosphate rock, and sulphur), and the values for several important minerals declined 20 to 50 per cent more than production. A decrease of only 5 per cent in the quantity of petroleum produced accompanied by a 49 per cent decline in total value is an outstanding illustration of the disparity in the rates of decrease for both output and value figures for a single commodity. It is not possible to arrive at a common denominator of quantity measurement by which the quantities produced by the mineral industry are reduced to a single figure for comparison with the aggregate value. In 1931, however, the general performance of the mines in physical production was better than the value figures indicate. Although production of most mineral products did decrease sharply in 1931, the declines in quantity were proportionately smaller than those in value.

One must also abandon the annual value figures in reviewing the month-to-month trends in business that affected the mineral industry in 1931, as most of the available current statistical indicators are in terms of quantity production only.

Mineral production, reflecting the output of coal and other raw materials, is highly sensitive to industrial changes. According to the Federal Reserve Board, factory production declined 15.8 per cent between 1930 and 1931, and there was no general uniformity in the extent of the decline among the various industries. Food products, leather products, and rubber tires and tubes suffered only small declines, while for some other industries the declines were slightly greater. Most pronounced, however, were the very sharp decreases in production in the heavy industries—iron and steel, lumber, cement, and nonferrous metals. These followed approximately the monthly course of the general index of manufacturing production, with a rise during the early months of 1931 followed by a generally steady decline to the end of the year that continued into the early months of 1932.

The extent to which the various mineral industries comprising the Federal Reserve Board general index of mineral production were affected by the depression varied widely. Although the monthly declines in the various mineral indexes were neither uniform nor continuous the December, 1931, indexes, in all except the petroleum industry, were notably below the December, 1930, levels. Improvement in the mineral industries must necessarily await recovery in manufacturing activity. The situation among the metals, however, is complicated by the existence of large stocks of nonferrous metals and the prevailing low prices for these commodities. Also, contracts awarded for construction of all types, which were 32 per cent less in 1931 than in 1930, will have to show definite increases before the relatively large and important industries that supply nonmetallic structural materials can expect to make reasonable gains.

SUMMARY

By M. B. Clark and E. T. Shuey

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PLAN OF REPORT

The scope of this series of summaries has been maintained with little change. The first four (1918 to 1921), in preliminary form, did not contain tables of production by States. Since 1922 the preliminary issues have carried State tables for the two years preceding the year designated by title. In the final form these reports have all contained tables of production by States for the title year. The plan of the reports comprises: (1) General summary tables of production; (2) detailed tables giving data on domestic production and on imports and exports of the various minerals, arranged in alphabetic order, for a series of years, and giving data on consumption, stocks, etc., for some important products; (3) State tables in alphabetic order.

Unit of measurement.—The unit of measurement used by the Bureau of Mines for each mineral product in the reports on the mineral resources is that common to the industry concerned, and the variation in these units makes it impracticable, if not impossible, directly to combine and compare the different minerals except as to value, especially because some products are measured by volume, although most are measured by weight.

Elimination of duplication.—In the totals for the United States, shown in the following general tables, duplication has been eliminated wherever practicable, and in the State totals given in the State tables virtually all duplication has been eliminated. For instance, in both general and State tables the output of coke is shown, but its value is not included in the totals, as the value of the coal used in its manufacture enters into the value of the coal production, which is included in the totals. The value of the products of the clay industries is included in both general and State totals as representing the first marketable form of the greater part of the clay produced; the quantity and value of the clay mined and sold in the raw state by miners to users of clay are shown separately, but the value is not included in the totals.

In the general tables both iron ore and pig iron are shown, but the value of the pig iron rather than that of the iron ore is included in the totals, as that is considered the better means of presenting the statistics for iron in its first marketable form. For gold, silver, copper, lead, and zinc the value of "smelter output" is included in the general totals, and in order to account more fully for the value of the ores treated these smelter figures are supplemented by the value of the by-product sulphuric acid. The value of pigments (white lead, red lead, lithopone, litharge, and orange mineral) manufactured from metals is not included in the general tables, as the base from which they are made is included in the output of lead or zinc, whereas the value of sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide is included, as these are made in large part direct from the ores and do not enter into the lead or zinc totals, which represent smelter output.

In the State tables also iron ore and pig iron are both shown. As blast-furnace products can not be distributed according to the States in which the ore is mined, the value of the ore is used in the State totals. For ores of gold, silver, copper, lead, and zinc no values are shown, and in fact none are recorded; instead, for each of these metals the recoverable content of the ores is used as the basis of valuation. The value of the zinc and lead pigments is not included in the State total, as the recoverable zinc and lead content of the ores from which the products were made is included under zinc or lead. The value of the sulphuric acid produced as a by-product of copper and zinc smelting is not included in the State total, as tracing this product back to the State producing the ore has not been possible.

GENERAL TABLES

Mineral products of the United States, 1930 and 1931[1]

Product	1930		1931	
	Quantity	Value	Quantity	Value
METALLIC				
Aluminum ... pounds	229,035,000	$50,961,000	177,544,000	$37,284,000
Antimonial lead [2] ... short tons (2,000 pounds)	13,711	1,392,524	(2)	(2)
Antimony [3] ... do	1,685	258,500	964	129,600
Bauxite ... long tons (2,240 pounds)	330,612	1,928,297	195,895	1,140,629
Cadmium ... pounds	2,777,762	1,777,768	1,050,529	409,706
Chromite ... long tons	80	1,905	268	3,509
Copper,[4] sales value ... pounds	1,394,389,327	181,271,000	1,042,711,178	94,887,000
Ferro-alloys ... long tons	650,240	51,900,220	398,295	30,764,549
Gold [5] ... troy ounces	2,285,603	47,247,600	2,395,878	49,527,200
Iron:				
Ore [6] ... long tons	55,201,221	[6] 145,619,059	28,516,032	[6] 74,123,910
Pig ... do	29,905,355	512,165,131	17,812,579	285,147,156
Lead (refined),[4] sales value ... short tons	573,740	57,374,000	390,260	28,879,000
Manganese ore (35 per cent or more Mn) ... long tons	67,035	1,437,465	39,242	699,121
Manganiferous ore (5 to 35 per cent Mn) ... long tons	785,390	2,401,605	281,414	976,549
Mercury:				
Metal ... flasks (76 pounds net)	21,553	2,478,789	24,947	2,179,145
Ore ... short tons	(7)	(8)	(7)	(8)
Nickel ... do	308	213,803	373	202,406
Ores (crude), old tailings, etc.:				
Copper ... do	47,382,000	(8)	34,049,000	(8)
Copper-lead and copper-lead-zinc ... do	246,000	(8)	213,000	(8)
Dry and siliceous (gold and silver) ... do	7,767,000	(8)	8,329,000	(8)
Lead ... do	8,080,000	(8)	6,043,000	(8)
Lead-zinc ... do	10,645,000	(8)	5,427,000	(8)
Zinc ... do	5,980,000	(8)	4,500,000	(8)
Platinum and allied metals (value at New York City) ... troy ounces	43,502	2,048,824	36,205	1,274,029
Silver ... do	50,748,127	19,538,029	30,932,050	8,970,294
Tin (metallic equivalent) ... short tons	17	10,500	4	2,050
Titanium ore:				
Ilmenite ... do	(9)	(9)	(9)	(9)
Rutile ... do	(9)	(9)	(9)	(9)
Tungsten ore (60 per cent concentrates) ... do	702	509,000	1,404	928,000
Uranium and vanadium ores ... do	(9)	(9)	(9)	(9)
Zinc,[4] sales value ... do	489,361	46,979,000	291,996	22,192,000
Total value of metallic products (approximate)	...	982,550,000	...	567,200,000
NONMETALLIC				
Arsenious oxide ... short tons	17,425	1,008,385	13,777	796,744
Asbestos ... do	4,242	289,284	3,228	118,967
Asphalt:				
Native ... do	702,777	4,463,092	503,383	2,930,451
Oil [6] ... do	[10] 2,167,068	[6] [10] 20,851,354	2,206,568	[6] 16,614,594
Barite (crude) ... do	234,932	1,538,171	174,520	994,655
Borates (colemanite and naturally occurring sodium borates) ... short tons	177,360	5,351,999	178,550	4,931,295
Bromine ... pounds	8,462,800	2,109,974	8,935,330	1,854,650
Calcium-magnesium chloride ... short tons	116,160	2,207,800	86,156	1,687,166
Cement ... barrels (376 pounds net)	160,846,350	231,249,287	128,377,384	142,579,826
Clay:				
Products [11]	...	275,134,322	...	177,562,025
Raw [6] ... short tons	3,962,903	[6] 12,521,495	2,519,495	[6] 8,352,185
Coal:				
Bituminous [12] ... do	467,526,299	795,483,000	382,089,396	588,895,000
Pennsylvania anthracite ... do	69,384,837	354,574,191	59,645,652	296,354,586
Coke [6] ... do	47,972,021	[6] 209,137,262	33,483,886	[6] 161,608,724
Diatomite and tripoli [13] ... do	32,439	507,505	26,682	310,131
Emery ... do	555	5,996	512	5,557
Feldspar (crude) ... long tons	171,788	1,066,636	147,119	861,059
Fluorspar ... short tons	95,849	1,746,643	53,484	931,275
Fuller's earth ... do	335,644	4,326,705	288,400	3,055,570
Garnet for abrasive purposes ... do	5,003	314,129	2,946	193,015
Gems and precious stones	...	(14)	...	(14)
Graphite:				
Amorphous ... short tons	1,941	20,525	(15)	(15)
Crystalline ... pounds	(15)	(15)	(15)	(15)
Grindstones and pulpstones ... short tons	18,700	770,571	8,724	342,149
Gypsum ... do	3,471,393	27,051,484	2,559,017	20,801,357
Lime ... do	3,387,880	25,616,486	2,707,614	18,674,913
Magnesite (crude) ... do	129,320	1,033,130	73,602	499,239

Footnotes at end of table.

Mineral products of the United States, 1930 and 1931—Continued

Product	1930		1931	
	Quantity	Value	Quantity	Value
NONMETALLIC—continued				
Mica:				
Scrap, short tons	6,732	$109,100	6,621	$99,415
Sheet, pounds	1,465,485	177,307	962,953	111,830
Millstones		17,702		5,330
Mineral paints:				
Natural pigments [16], short tons	(16)	(16)	(16)	(16)
Zinc and lead pigments [17], do	147,948	18,420,436	123,963	15,225,300
Mineral waters, gallons sold	(14)	(14)	(14)	(14)
Natural gas, M cubic feet	1,943,421,000	416,090,000	1,686,436,000	392,816,000
Natural gasoline, gallons	2,210,494,000	128,160,000	1,831,918,000	63,732,000
Oilstones, etc., short tons	651	137,184	370	81,951
Peat, do	(14)	(14)	(14)	(14)
Petroleum, barrels (42 gallons)	898,011,000	1,070,200,000	851,081,000	550,630,000
Phosphate rock, long tons	3,926,392	13,996,830	2,534,959	9,288,485
Potassium salts, short tons	[18] 56,610	2,986,157	[18] 63,770	3,086,955
Pumice, do	56,843	336,099	68,819	338,586
Pyrites, long tons	347,512	1,028,680	330,848	974,820
Salt, short tons	8,054,440	25,009,480	7,358,070	21,541,012
Sand:				
Glass, do	1,849,101	3,210,973	1,677,882	2,779,245
Molding, building, etc., and gravel, do	195,202,625	111,965,570	151,801,162	83,501,075
Sand-lime brick [19], thousands	191,193	1,950,709	143,673	1,236,825
Silica (quartz), short tons	13,156	121,289	7,851	69,103
Slate, do	463,610	7,911,618	368,420	5,498,336
Stone, do	126,996,340	178,948,611	97,933,180	135,085,627
Sulphur, long tons	1,989,917	35,800,000	1,376,526	24,800,000
Sulphuric acid (60° Baumé) from copper and zinc smelters, short tons	1,188,316	9,544,283	862,729	6,491,515
Talc and soapstone [20], do	179,385	2,108,338	163,752	1,852,472
Total value of nonmetallic products (approximate)		3,773,400,000		2,592,100,000
SUMMARY				
Total value of metallic products		982,550,000		567,200,000
Total value of nonmetallic products (exclusive of mineral fuels)		1,008,900,000		699,700,000
Total value of mineral fuels		2,764,500,000		1,892,400,000
Total value of "unspecified" (metallic and nonmetallic) products (partly estimated) [21]		8,850,000		[21] 7,300,000
Grand total approximate value of mineral products		4,764,800,000		3,166,600,000

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[1] In this general statement certain of the figures represent shipments rather than quantity mined. The reader is referred to the following sections on the various mineral products for information in greater detail than it seems practicable to give here.

[2] From both domestic and foreign ores. As the result of a change in method of statistical presentation, comparable figures for 1931 are not available; estimate of value of antimony and lead contents of antimonial lead from primary domestic sources included in total value of metallic products.

[3] Figures represent antimony content of antimonial lead. Value excluded from metallic total as the value of the antimony is included in the antimonial lead value.

[4] Product from domestic ores only.

[5] Value, $20.671834625323 an ounce.

[6] Value not included in total value.

[7] Figures not available.

[8] Figures showing values not available.

[9] Value included in total value of metallic products; Bureau of Mines not at liberty to publish figures.

[10] Revised figures.

[11] Figures obtained through cooperation with Bureau of the Census.

[12] Includes brown coal and lignite, and anthracite mined elsewhere than in Pennsylvania.

[13] Figures represent tripoli only. Value of diatomite is included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[14] No canvass. Estimate of value included in total value of nonmetallic products.

[15] Value included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[16] Canvass discontinued after 1915. Value of iron ore sold for paint included under last item ("Unspecified").

[17] Sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide.

[18] Equivalent as K_2O.

[19] According to Bureau of the Census.

[20] Figures represent talc only. Value of soapstone is included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[21] Includes for 1931 the value of bismuth, cadmium compounds ($331,119), chats ($368,000), cobalt ore, columbite ($490), flint lining for tube mills and pebbles for grinding ($26,211), optical fluorspar ($1,230), iodine, iron ore sold for magnets, iron ore sold for paint ($29,759), lithium minerals, new ingot magnesium ($199,633), natural magnesium salts ($982,814), calcareous marl ($65,935), greensand marl ($196,327), micaceous minerals ($47,500), molybdenum ($1,577,000), selenium ($386,255), silica sand and sandstone (finely ground) ($749,171), sodium salts (carbonates and sulphates) from natural sources ($1,421,676), sulphur ore, tellurium, and an estimate of the value of miscellaneous mineral products, statistics for which are not collected annually by the Bureau of Mines.

Value of mineral products of the United States, 1880–1931

Year	Metallic		Nonmetallic		Unspecified (metallic and nonmetallic)	Total	
	Value	Increase or decrease, per cent	Value	Increase or decrease, per cent		Value	Increase or decrease, per cent
1880	$187, 881, 000	(1)	$173, 582, 000	(1)	$6, 000, 000	$367, 463, 000	(1)
1881	189, 413, 000	+0. 8	207, 207, 000	+19	6, 500, 000	403, 120, 000	+10
1882	215, 820, 000	+14	230, 786, 000	+11	6, 500, 000	453, 106, 000	+12
1883	197, 881, 000	−8	243, 680, 000	+6	6, 500, 000	448, 061, 000	−1
1884	180, 284, 000	−9	221, 756, 000	−9	5, 000, 000	407, 040, 000	−9
1885	172, 218, 000	−4	242, 333, 000	+9	5, 000, 000	419, 551, 000	+3
1886	204, 400, 000	+19	250, 995, 000	+4	790, 000	456, 185, 000	+9
1887	240, 791, 000	+18	294, 057, 000	+17	785, 000	535, 633, 000	+17
1888	242, 010, 000	+. 5	310, 889, 000	+6	900, 000	553, 799, 000	+3
1889	250, 325, 000	+3	291, 004, 000	−6	997, 000	542, 326, 000	−2
1890	303, 440, 000	+21	310, 995, 000	+7	994, 000	615, 429, 000	+13
1891	280, 485, 000	−8	319, 364, 000	+3	1, 000, 000	600, 849, 000	−2
1892	283, 715, 000	+1	337, 517, 000	+6	1, 000, 000	622, 232, 000	+4
1893	223, 154, 000	−21	321, 339, 000	−5	1, 000, 000	545, 493, 000	−12
1894	186, 835, 000	−16	362, 410, 000	+13	1, 000, 000	550, 245, 000	+. 9
1895	248, 033, 000	+33	393, 658, 000	+9	1, 000, 000	642, 691, 000	+17
1896	252, 075, 000	+2	387, 966, 000	−1	1, 000, 000	641, 041, 000	−. 3
1897	269, 934, 000	+7	380, 678, 000	−2	1, 000, 000	651, 612, 000	+2
1898	308, 247, 000	+14	417, 795, 000	+10	1, 000, 000	727, 042, 000	+12
1899	483, 521, 000	+57	525, 575, 000	+26	1, 000, 000	1, 010, 096, 000	+39
1900	513, 732, 000	+6	594, 204, 000	+13	1, 000, 000	1, 108, 936, 000	+10
1901	493, 314, 000	−4	660, 764, 000	+11	1, 000, 000	1, 155, 078, 000	+4
1902	604, 517, 000	+23	722, 434, 000	+9	1, 000, 000	1, 327, 951, 000	+15
1903	588, 753, 000	−3	905, 628, 000	+25	1, 000, 000	1, 495, 381, 000	+13
1904	501, 114, 000	−15	857, 667, 000	−5	400, 000	1, 359, 181, 000	−9
1905	702, 585, 000	+40	920, 780, 000	+7	400, 000	1, 623, 765, 000	+19
1906	886, 180, 000	+26	1, 014, 500, 000	+10	200, 000	1, 900, 880, 000	+17
1907	904, 108, 000	+2	1, 165, 376, 000	+15	86, 000	2, 069, 570, 000	+9
1908	550, 768, 000	−39	1, 040, 761, 000	−11	244, 000	1, 591, 773, 000	−23
1909	754, 944, 000	+37	1, 131, 866, 000	+9	297, 000	1, 887, 107, 000	+19
1910	749, 879, 000	−. 7	1, 237, 668, 000	+9	297, 000	1, 987, 844, 000	+5
1911	680, 907, 000	−9	1, 242, 942, 000	+. 4	232, 000	1, 924, 081, 000	−3
1912	862, 008, 000	+27	1, 375, 420, 000	+11	366, 000	2, 237, 794, 000	+16
1913	878, 869, 000	+2	1, 554, 298, 000	+13	378, 000	2, 433, 545, 000	+9
1914	686, 639, 000	−22	1, 424, 063, 000	−8	470, 000	2, 111, 172, 000	−13
1915	991, 730, 000	+44	1, 400, 484, 000	−2	2, 430, 000	2, 394, 644, 000	+13
1916	1, 620, 745, 000	+63	1, 884, 413, 000	+35	3, 281, 000	3, 508, 439, 000	+47
1917	2, 086, 234, 000	+29	2, 900, 462, 000	+54	5, 800, 000	4, 992, 496, 000	+42
1918	2, 153, 318, 000	+3	3, 380, 690, 000	+17	6, 700, 000	5, 540, 708, 000	+11
1919	1, 359, 744, 000	−37	3, 232, 626, 000	−4	3, 400, 000	4, 595, 770, 000	−17
1920	1, 762, 350, 000	+30	5, 214, 170, 000	+61	4, 820, 000	6, 981, 340, 000	+52
1921	654, 130, 000	−63	3, 481, 720, 000	−33	2, 650, 000	4, 138, 500, 000	−41
1922	987, 180, 000	+51	3, 656, 410, 000	+5	3, 700, 000	4, 647, 290, 000	+12
1923	1, 510, 930, 000	+53	4, 471, 620, 000	+22	3, 950, 000	5, 986, 500, 000	+29
1924	1, 232, 330, 000	−18	4, 067, 730, 000	−9	5, 740, 000	5, 305, 800, 000	−11
1925	1, 380, 280, 000	+12	4, 291, 100, 000	+5	6, 250, 000	5, 677, 630, 000	+7
1926	1, 402, 920, 000	+2	4, 803, 080, 000	+12	7, 600, 000	6, 213, 600, 000	+9
1927	1, 217, 700, 000	−13	4, 304, 100, 000	−10	8, 200, 000	5, 530, 000, 000	−11
1928	1, 284, 580, 000	+5	4, 091, 620, 000	−5	9, 000, 000	5, 385, 200, 000	−3
1929	1, 475, 990, 000	+15	4, 401, 180, 000	+8	10, 430, 000	5, 887, 600, 000	+9
1930	982, 550, 000	−33	3, 773, 400, 000	−14	8, 850, 000	4, 764, 800, 000	−19
1931	567, 200, 000	−42	2, 592, 100, 000	−31	7, 300, 000	3, 166, 600, 000	−34
Grand total	37, 948, 690, 000	---------	84, 018, 862, 000	-------	156, 437, 000	122, 123, 989, 000	-------

[1] Figures for earlier years not available.

Value of mineral products of the United States, 1927–1931, by States [1]

State	1927	1928	1929	1930	1931
Alabama	$78, 640, 669	$69, 807, 334	$65, 402, 354	$55, 461, 985	$38, 506, 558
Alaska	14, 402, 440	14, 024, 489	15, 946, 830	13, 707, 235	12, 371, 057
Arizona	100, 558, 556	115, 999, 643	157, 959, 792	82, 933, 802	41, 602, 929
Arkansas	59, 449, 100	45, 009, 780	41, 324, 576	34, 901, 476	18, 692, 379
California	459, 497, 072	434, 261, 175	555, 001, 213	479, 049, 507	304, 538, 557
Colorado	58, 855, 263	58, 594, 688	55, 331, 911	46, 270, 545	32, 970, 230
Connecticut	7, 299, 100	7, 599, 655	7, 053, 468	5, 485, 120	4, 299, 790
Delaware	493, 377	481, 584	467, 493	424, 901	394, 579
District of Columbia	1, 374, 719	1, 031, 216	1, 064, 946	1, 288, 344	281, 980
Florida	18, 095, 961	15, 227, 123	14, 803, 606	15, 484, 206	10, 850, 806
Georgia	16, 758, 390	14, 740, 431	15, 294, 103	12, 830, 845	10, 290, 593
Idaho	29, 183, 929	28, 589, 221	32, 142, 685	22, 903, 659	13, 177, 427
Illinois	180, 393, 779	188, 098, 866	182, 791, 131	148, 311, 418	108, 065, 936
Indiana	107, 578, 234	98, 583, 915	96, 961, 947	79, 226, 808	50, 852, 088
Iowa	33, 426, 375	35, 498, 669	35, 954, 895	33, 357, 958	21, 614, 611
Kansas	120, 368, 526	113, 279, 524	124, 472, 480	100, 253, 311	56, 804, 312
Kentucky	152, 614, 177	131, 969, 907	132, 649, 508	111, 691, 254	74, 868, 106
Louisiana	51, 266, 921	56, 810, 403	62, 725, 997	71, 929, 038	61, 692, 802
Maine	5, 475, 695	5, 922, 729	6, 748, 799	6, 227, 528	4, 889, 282
Maryland	20, 469, 294	18, 417, 781	18, 469, 568	14, 989, 695	11, 330, 323
Massachusetts	16, 295, 373	16, 234, 037	16, 030, 807	12, 722, 974	11, 170, 497
Michigan	124, 029, 572	123, 825, 527	151, 975, 563	111, 405, 530	62, 785, 908
Minnesota	102, 972, 753	108, 274, 963	136, 349, 610	103, 931, 377	55, 275, 230
Mississippi	2, 553, 633	2, 634, 347	2, 572, 616	1, 774, 621	2, 387, 771
Missouri	75, 890, 415	74, 981, 382	78, 948, 484	69, 074, 500	41, 805, 772
Montana	68, 264, 687	74, 752, 309	93, 842, 135	50, 995, 123	32, 359, 904
Nebraska	3, 541, 792	3, 454, 700	4, 844, 542	4, 962, 012	3, 623, 426
Nevada	26, 753, 295	34, 881, 787	36, 775, 743	24, 075, 375	14, 963, 785
New Hampshire	3, 447, 105	3, 816, 065	3, 725, 951	3, 337, 169	2, 796, 132
New Jersey	73, 090, 810	70, 865, 363	71, 891, 861	57, 206, 357	41, 632, 683
New Mexico	28, 608, 776	30, 426, 840	37, 127, 621	31, 850, 263	25, 349, 712
New York	112, 209, 533	108, 025, 720	109, 361, 349	99, 622, 368	78, 007, 467
North Carolina	11, 703, 671	11, 480, 406	10, 963, 896	7, 462, 450	5, 554, 190
North Dakota	2, 869, 663	3, 082, 621	3, 465, 563	3, 056, 493	2, 271, 454
Ohio	226, 962, 529	211, 041, 279	220, 061, 343	186, 971, 555	130, 927, 783
Oklahoma	524, 594, 732	486, 634, 347	516, 685, 232	390, 170, 991	181, 904, 857
Oregon	6, 821, 224	6, 686, 988	6, 876, 703	6, 169, 898	5, 045, 307
Pennsylvania	936, 773, 189	881, 490, 033	892, 913, 833	778, 523, 421	594, 642, 786
Rhode Island	1, 310, 756	830, 742	939, 602	1, 209, 227	792, 911
South Carolina	4, 251, 137	4, 045, 849	3, 592, 112	3, 341, 051	3, 031, 459
South Dakota	8, 463, 952	9, 443, 488	8, 914, 344	11, 075, 808	11, 338, 739
Tennessee	37, 874, 981	39, 216, 757	40, 719, 706	32, 499, 380	24, 461, 447
Texas	374, 503, 420	378, 616, 955	495, 819, 500	450, 373, 151	302, 201, 046
Utah	90, 388, 455	97, 381, 148	115, 131, 131	64, 224, 307	40, 301, 788
Vermont	14, 702, 891	14, 648, 737	14, 602, 589	11, 637, 393	8, 421, 911
Virginia	41, 322, 998	38, 770, 281	39, 752, 683	34, 602, 749	26, 150, 041
Washington	21, 965, 917	22, 119, 541	22, 435, 359	20, 075, 844	14, 800, 608
West Virginia	366, 643, 205	336, 636, 948	346, 564, 746	290, 118, 914	221, 734, 789
Wisconsin	21, 776, 847	20, 938, 179	24, 222, 229	17, 711, 394	11, 843, 343
Wyoming	56, 166, 600	52, 950, 875	51, 237, 407	46, 735, 184	30, 892, 663

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[1] In this table iron ore, not pig iron, is taken as the basis of valuation of iron, and in the case of other metals mine production (recoverable content of metals) is the basis.

Mineral products of the United States and principal producing States in 1931

Rank in value	Product	Principal producing States[1]	
		In order of quantity	In order of value
14	Aluminum	New York, Tennessee, North Carolina	Rank same as for quantity.
(2)	Antimonial lead	Not separable by States	Not separable by States.
52	Arsenious oxide	Montana, Utah	Rank same as for quantity.
69	Asbestos	Vermont, Georgia, Arizona, Washington	Vermont, Arizona, Georgia, Maryland.
	Asphalt:		
34	Native	Texas, Kentucky, Utah, Alabama	Kentucky, Utah, Texas, Oklahoma.
22	Oil	Not separable by States	Not separable by States.
45	Barite (crude)	Missouri, Georgia, California, Tennessee	Rank same as for quantity.
44	Bauxite	Arkansas, Georgia, Alabama	Do.
58	Bismuth	Not separable by States	Not separable by States.
31	Borates	California	Rank same as for quantity.
30	Briquets, fuel	Wisconsin, Pennsylvania, West Virginia, Massachusetts	Wisconsin, Pennsylvania, Oregon, West Virginia.
37	Bromine	Michigan, California, West Virginia, Ohio	Rank same as for quantity.
54	Cadmium (metal and compounds)	Not separable by States	Not separable by States.
38	Calcium-magnesium chloride	Michigan, California, West Virginia, Ohio	Rank same as for quantity.
7	Cement	Pennsylvania, New York, Indiana, California	Pennsylvania, California, New York, Texas.
60	Chats	Missouri, Oklahoma, Kansas	Rank same as for quantity.
83	Chromite	California	Do.
5	Clay products		Ohio, Pennsylvania, New Jersey, West Virginia.
26	Clay, raw	Pennsylvania, California, Georgia, Ohio	Georgia, Pennsylvania, Missouri, Kentucky.
1	Coal:		
	Bituminous	West Virginia, Pennsylvania, Illinois, Kentucky	Pennsylvania, West Virginia, Illinois, Kentucky.
	Pennsylvania anthracite	Pennsylvania	Rank same as for quantity.
85	Cobalt ore	Alabama	Do.
6	Coke	Pennsylvania, Ohio, New York, Alabama	Pennsylvania, New York, Ohio, Indiana.
86	Columbite	New Mexico, South Dakota	Rank same as for quantity.
9	Copper	Arizona, Montana, Utah, Michigan	Do.
40	Diatomite and tripoli	California, Illinois, Missouri, Oklahoma	California, Missouri, Illinois, Oklahoma.
80	Emery	New York	Rank same as for quantity.
51	Feldspar (crude)	North Carolina, New Hampshire, South Dakota, Maine	North Carolina, New Hampshire, Maine, Virginia.
15	Ferro-alloys	Pennsylvania, New York, Ohio, Alabama	Rank same as for quantity.
76	Flint lining for tube mills	Minnesota	Do.
49	Fluorspar	Illinois, Kentucky, New Mexico, Colorado	Do.
33	Fuller's earth	Georgia, Florida, Illinois, Texas	Florida, Georgia, Illinois, Texas.
68	Garnet, abrasive	New York, New Hampshire	Rank same as for quantity.
(3)	Gems and precious stones	No canvass for 1931	No canvass for 1931.
13	Gold	California, Alaska, South Dakota, Colorado	Rank same as for quantity.
79	Graphite		Alabama, Michigan, Nevada.
	Amorphous	Nevada, Michigan	Michigan, Nevada.
	Crystalline	Alabama	Rank same as for quantity.

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[1] Rank of States in metal production (except aluminum, ferro-alloys, and pig iron) arranged according to mine reports, not smelter output.

[2] Separate figures for antimonial lead from primary sources not available.

[3] No canvass for 1931.

Mineral products of the United States and principal producing States in 1931—Continued

Rank in value	Product	Principal producing States	
		In order of quantity	In order of value
61	Grindstones and pulpstones	Ohio, West Virginia, Illinois, Michigan	Ohio, West Virginia, Washington, Michigan.
20	Gypsum	New York, Michigan, Iowa, Texas	Rank same as for quantity.
56	Iodine (natural)	California	Do.
11	Iron ore	Minnesota, Michigan, Alabama, Wisconsin	Do.
4	Iron, pig	Pennsylvania, Ohio, Illinois, Indiana	Do.
16	Lead	Missouri, Idaho, Utah, Oklahoma	Do.
21	Lime	Ohio, Pennsylvania, Missouri, West Virginia	Ohio, Pennsylvania, Missouri, Massachusetts.
75	Lithium minerals	South Dakota	Rank same as for quantity.
57	Magnesite	Washington, California	Do.
66	Magnesium	Michigan	Do.
46	Magnesium salts (natural)	Michigan, California	Do.
55	Manganese ore	Montana, Georgia, Arkansas, Virginia	Montana, Arkansas, Georgia, Virginia.
47	Manganiferous ore	Minnesota, Montana, Georgia, Colorado	Minnesota, Georgia, Montana, Colorado.
64	Manganiferous zinc residuum	New Jersey	Rank same as for quantity.
	Marl:		
73	Calcareous	Virginia, Michigan, West Virginia, California	Virginia, California, West Virginia, Michigan.
67	Greensand	New Jersey	Rank same as for quantity.
36	Mercury	California, Oregon, Texas, Nevada	Do.
63	Mica	North Carolina, New Hampshire, Virginia, Connecticut	North Carolina, New Hampshire, Connecticut, Virginia.
	Scrap	North Carolina, Virginia, Connecticut, New Hampshire	Do.
	Sheet	New Hampshire, North Carolina, Connecticut, Georgia	North Carolina, New Hampshire, Connecticut, Georgia.
74	Micaceous minerals	North Carolina, Montana, Georgia, Colorado	Montana, Georgia, North Carolina, Colorado.
81	Millstones		North Carolina, New York, Virginia.
23	Mineral paints, zinc and lead pigments	Pennsylvania, Ohio, Indiana, Kansas	Pennsylvania, Ohio, Indiana, Illinois.
(3)	Mineral waters	No canvass for 1931	No canvass for 1931.
39	Molybdenum	Colorado, New Mexico, Arizona	Rank same as for quantity.
3	Natural gas	Texas, California, Oklahoma, Louisiana	California, Texas, West Virginia, Pennsylvania.
12	Natural gasoline	California, Oklahoma, Texas, Louisiana	California, Oklahoma, Texas, West Virginia.
65	Nickel	Not separable by States	Not separable by States.
70	Oilstones, etc	Ohio, Vermont, Arkansas, Indiana	Arkansas, Ohio, Vermont, Indiana.
(3)	Peat	No canvass for 1931	No canvass for 1931.
77	Pebbles for grinding	Minnesota, California	Rank same as for quantity.
2	Petroleum	Texas, California, Oklahoma, Kansas	Do.
24	Phosphate rock	Florida, Tennessee, Montana, Idaho	Do.
41	Platinum and allied metals	California, Alaska, Oregon	Do.
32	Potassium salts	California, New Mexico, Maryland, Nevada	California, Maryland, New Mexico, Nevada.
62	Pumice	Kansas, California, Nebraska, Oklahoma	Kansas, California, Nebraska, South Dakota.
48	Pyrites	Tennessee, Virginia, New York, California	Tennessee, Virginia, California, New York.
19	Salt	Michigan, New York, Ohio, Kansas	Michigan, New York, Kansas, Ohio.
10	Sand and gravel	New York, Illinois, Indiana, California	New York, Pennsylvania, California, Ohio.
43	Sand-lime brick	New York, Michigan, Massachusetts, Minnesota	Rank same as for quantity.
59	Selenium	Not separable by States	Not separable by States.

72	Silica (quartz)	Wisconsin, North Carolina, California, Ohio	Wisconsin, California, North Carolina, Maryland.
53	Silica sand and sandstone (finely ground)	Pennsylvania, Illinois, Ohio, New Jersey	Pennsylvania, Illinois, Ohio, West Virginia.
25	Silver	Utah, Idaho, Montana, Arizona	Rank same as for quantity.
29	Slate		Pennsylvania, Vermont, New York, Virginia.
28	Sodium salts (other than NaCl) from natural sources.	California, Arizona, Wyoming, Nevada	Rank same as for quantity.
8	Stone	New York, Pennsylvania, Ohio, Michigan	New York, Pennsylvania, Indiana, Ohio.
17	Sulphur	Texas, Nevada	Rank same as for quantity.
27	Sulphuric acid from copper and zinc smelters.	Tennessee, Illinois, Pennsylvania, Oklahoma	Do.
35	Talc and soapstone	New York, Vermont, North Carolina, Virginia	New York, Virginia, Vermont, California.
78	Tellurium	Not separable by States	Not separable by States.
84	Tin	Alaska, South Dakota	Rank same as for quantity.
	Titanium ore:		
82	Ilmenite	Virginia	Do.
71	Rutile	do	Do.
50	Tungsten ore	Nevada, Colorado, Arizona, California	Do.
42	Uranium and vanadium ores	Colorado, Utah, New Mexico	Do.
18	Zinc	New Jersey, Oklahoma, Kansas, Utah	Do.

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[a] No canvass for 1931.

States and their principal mineral products in 1931 [1]

State	Rank	Percentage of total value for United States	Principal mineral products in order of value
Alabama	19	1.34	Coal, iron ore, cement, stone.
Alaska	31	.43	Gold, copper, coal, lead.
Arizona	17	1.45	Copper, gold, silver, stone.
Arkansas	27	.65	Petroleum, coal, natural gas, bauxite.
California	2	10.62	Petroleum, natural gas, natural gasoline, cement.
Colorado	20	1.15	Coal, gold, clay products, cement.
Connecticut	42	.15	Stone, clay products, sand and gravel, lime.
Delaware	49	.01	Stone, clay products, sand and gravel, silica sand and sand stone (finely ground).
District of Columbia	50	.01	Clay products, sand and gravel, stone.
Florida	36	.38	Phosphate rock, stone, fuller's earth, cement.
Georgia	37	.36	Stone, cement, clay products, fuller's earth.
Idaho	30	.46	Lead, silver, zinc, stone.
Illinois	7	3.77	Coal, clay products, cement, sand and gravel.
Indiana	14	1.77	Coal, stone, cement, clay products.
Iowa	26	.75	Coal, cement, gypsum, clay products.
Kansas	12	1.98	Petroleum, natural gas, cement, coal.
Kentucky	9	2.61	Coal, natural gas, petroleum, clay products.
Louisiana	11	2.15	Natural gas, petroleum, sand and gravel, salt.
Maine	41	.17	Stone, cement, sand and gravel, clay products.
Maryland	34	.40	Coal, clay products, cement, sand and gravel.
Massachusetts	35	.39	Stone, sand and gravel, clay products, lime.
Michigan	10	2.19	Iron ore, copper, cement, salt.
Minnesota	13	1.93	Iron ore, stone, sand and gravel, cement.
Mississippi	46	.08	Natural gas, sand and gravel, clay products, stone.
Missouri	15	1.46	Lead, coal, clay products, cement.
Montana	21	1.13	Copper, coal, natural gas, petroleum.
Nebraska	43	.13	Cement, sand and gravel, clay products, stone.
Nevada	28	.52	Copper, gold, sand and gravel, zinc.
New Hampshire	45	.10	Stone, sand and gravel, clay products, feldspar.
New Jersey	16	1.45	Clay products, zinc, sand and gravel, stone.
New Mexico	24	.89	Petroleum, copper, coal, natural gas.
New York	8	2.72	Stone, clay products, cement, sand and gravel.
North Carolina	39	.19	Stone, clay products, copper, feldspar.
North Dakota	47	.08	Coal, clay products, sand and gravel.
Ohio	6	4.57	Clay products, natural gas, coal, stone.
Oklahoma	5	6.35	Petroleum, natural gas, natural gasoline, zinc.
Oregon	40	.18	Stone, cement, sand and gravel, mercury.
Pennsylvania	1	20.74	Coal, natural gas, cement, petroleum.
Rhode Island	48	.03	Stone, sand and gravel, clay products, lime.
South Carolina	44	.11	Stone, clay products, sand and gravel, gold.
South Dakota	33	.40	Gold, sand and gravel, stone, cement.
Tennessee	25	.85	Coal, stone, cement, clay products.
Texas	3	10.54	Petroleum, natural gas, sulphur, natural gasoline.
Utah	18	1.41	Copper, coal, lead, gold.
Vermont	38	.29	Stone, slate, talc, lime.
Virginia	23	.91	Coal, stone, cement, clay products.
Washington	29	.52	Coal, cement, stone, clay products.
West Virginia	4	7.74	Coal, natural gas, clay products, petroleum.
Wisconsin	32	.41	Stone, sand and gravel, clay products, iron ore.
Wyoming	22	1.08	Coal, petroleum, natural gas, natural gasoline.

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[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and in the case of other metals mine production (recoverable content of metals) is the basis.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver [1]	Copper [2]	Lead [2]	Zinc [2]
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064
1928	.585	.144	.058	.061
1929	.533	.176	.063	.066
1930	$0.385	$0.130	$0.050	$0.048
1931	.290	.091	.037	.038

[1] Average price furnished by Bureau of the Mint.

[2] Average price, all grades.

DETAILED TABLES

ABRASIVE MATERIALS

Natural abrasives sold by producers in the United States, 1927–1931 [1]

Year	Millstones [2]	Grindstones		Pulpstones		Oilstones and scythestones		Emery	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	$35, 438	23, 222	$633, 207	8, 709	$921, 543	1, 048	$233, 545	506	$5, 855
1928	42, 886	24, 222	606, 408	9, 016	902, 429	956	228, 245	1, 341	16, 787
1929	31, 407	21, 071	617, 618	6, 665	623, 928	838	212, 017	924	10, 722
1930	17, 702	14, 559	423, 835	4, 141	346, 736	651	137, 184	555	5, 996
1931	5, 330	6, 994	221, 272	1, 730	120, 877	370	81, 951	512	5, 557

Year	Garnet		Diatomite		Tripoli (including rottenstone)			Pumice and pumicite		Grinding pebbles and tube-mill lining	
						Value					
	Short tons	Value	Short tons	Value	Short tons	Crude (estimated)	As sold (crude and finished)	Short tons	Value	Short tons	Value
1927	6, 939	$573, 525	(3)	(3)	26, 099	$66, 452	$447, 068	53, 298	$221, 481	3, 342	$46, 856
1928	6, 617	459, 307	(2)	(3)	34, 043	73, 689	555, 576	57, 430	278, 516	6, 288	89, 321
1929	5, 961	435, 420	(3)	(3)	38, 011	74, 475	545, 658	67, 013	353, 064	4, 630	66, 178
1930	5, 003	314, 129	(3)	(3)	32, 439	71, 790	507, 505	56, 843	336, 099	3, 480	50, 816
1931	2, 946	193, 015	(3)	(3)	26, 682	56, 248	310, 131	68, 819	338, 586	2, 024	26, 211

[1] For figures on abrasive feldspar and quartz, see sections on feldspar and silica.
[2] Figures for quantity not available.
[3] Bureau of Mines not at liberty to publish figures.

Value of abrasive materials imported for consumption in the United States, 1927–1931

Material	1927	1928	1929	1930	1931
Millstones and burrstones	$12, 726	$6, 354	$6, 564	$7, 050	$2, 435
Grindstones	134, 804	114, 874	119, 264	66, 677	39, 171
Hones, oilstones, and whetstones	67, 368	45, 303	48, 207	40, 612	24, 881
Emery and corundum	264, 613	272, 533	494, 174	329, 752	151, 501
Garnet	----------	115	----------	----------	149
Diatomaceous earth, tripoli, and rottenstone [1]	15, 403	21, 883	23, 183	46, 478	53, 581
Pumice	124, 074	159, 430	143, 944	94, 387	77, 168
Diamond:					
Dust and bort	62, 045	31, 222	89, 363	90, 945	20, 292
Glaziers' and engravers', unset, and miners'	2, 148, 275	2, 756, 895	4, 067, 674	2, 756, 630	2, 400, 879
Flint, flints, and flint stones, unground	93, 658	144, 313	127, 457	62, 463	54, 623

[1] Beginning June 18, 1930, classification reads "Tripoli and rottenstone."

Value of domestic abrasive materials exported, 1927–1931

Material	1927	1928	1929	1930	1931
Grindstones	$578, 113	$560, 975	$391, 239	$246, 512	$104, 602
Abrasive wheels, emery, and other	240, 027	254, 493	286, 360	203, 371	115, 076
All other natural abrasives, hones, whetstones, etc	419, 088	453, 055	423, 363	361, 055	232, 196

ALUMINUM

[See Bauxite and aluminum]

ANTIMONY AND ANTIMONIAL LEAD

The only production of antimony ore in the United States in the 5-year period, 1927 to 1931, was in 1928, as follows: 86 short tons of ore containing 42 tons of antimony.

Only two smelters reported production of metallic antimony in the United States in 1927 and only one in 1928 and 1931; the Bureau of Mines is not at liberty to publish the figures. No production was reported for 1929 and 1930. The total output in 1928 came from domestic ore smelted.

Secondary antimony and antimony content of secondary alloys recovered from old alloys, scrap, and dross in the United States, 1927–1931

Year	Short tons	Value [1]	Year	Short tons	Value [1]
1927	12, 400	$3, 060, 300	1930	8, 082	$1, 239, 800
1928	11, 900	2, 451, 400	1931	7, 900	1, 061, 800
1929	11, 131	1, 990, 200			

[1] Values calculated at average yearly price for ordinary brands of antimony as published by the American Metal Market.

By-product antimonial lead produced in the United States from both foreign and domestic ores, 1927–1930 [1]

Year	Short tons	Value	Antimony content (short tons)	Year	Short tons	Value	Antimony content (short tons)
1927	24, 347	$3, 277, 043	2, 736	1929	25, 669	$3, 267, 095	3, 052
1928	33, 058	3, 978, 318	3, 432	1930	13, 711	1, 392, 524	1, 685

[1] As the result of a change in method of statistical presentation, comparable figures for 1931 are not available.

Antimonial lead produced at primary refineries in the United States from both domestic and foreign primary and secondary sources, 1927–1931, in short tons

1927	33, 939	1930	24, 797
1928	45, 476	1931	21, 842
1929	43, 244		

Antimony imported for consumption in the United States, 1927–1931

Year	Antimony ore			Liquated antimony sulphide		Metallic antimony		Antimony oxides and other compounds	
	Short tons	Antimony content		Short tons	Value	Short tons	Value	Short tons	Value
		Short tons	Value						
1927	3, 566	2, 015	$282, 098	1, 077	$134, 949	9, 891	$2, 111, 411	1, 803	$484, 873
1928	3, 912	2, 185	313, 127	1, 208	158, 231	9, 684	1, 641, 265	2, 643	448, 156
1929	3, 161	1, 865	231, 086	1, 803	174, 104	11, 073	1, 622, 182	2, 222	359, 247
1930	1, 461	863	91, 499	713	45, 806	7, 700	883, 448	783	119, 314
1931	14, 015	4, 863	259, 952	650	30, 481	3, 753	357, 907	833	111, 500

Foreign antimony (matte, regulus, or metal) exported fom the United States, 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	726, 694	$72, 280	1930	985, 505	$54, 634
1928	1, 198, 339	90, 975	1931	1, 393, 580	74, 668
1929	1, 017, 656	71, 415			

ARSENIC

White arsenic (refined and crude) sold by producers in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	11, 560	$725, 360	1930	17, 425	$1, 008, 385
1928	11, 767	735, 373	1931	13, 777	796, 744
1929	14, 546	883, 771			

Arsenic compounds and metallic arsenic imported for consumption in the United States, 1927–1931

Year	Arsenious acid (white arsenic, As_2O_3)		Arsenic sulphide (realgar and orpiment)		Sheep dip		Paris green and London purple	
	Short tons	Value	Short tons	Value	Pounds	Value	Pounds	Value
1927	12, 517	$921, 998	206	$35, 089	102, 394	$8, 952	----------	----------
1928	11, 153	775, 169	263	51, 278	175, 055	17, 592	13, 279	$1, 497
1929	13, 157	956, 176	212	40, 976	208, 770	21, 533	1, 102	200
1930	10, 471	725, 991	277	47, 235	174, 215	18, 517	19, 024	1, 595
1931	7, 791	451, 468	299	46, 423	154, 530	14, 017	2, 340	341

Year	Arsenic acid (H_3AsO_4)		Calcium arsenate		Lead arsenate		Metallic arsenic	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1927	11, 685	$470	3, 807	$717	----------	----------	245, 686	$47, 875
1928	75	30	1, 323	233	----------	----------	186, 622	35, 584
1929	247	26	----------	----------	200	$26	287, 545	50, 730
1930	201	64	6, 359	387	800	62	113, 440	19, 006
1931	12, 061	430	40, 950	2, 125	----------	----------	28, 661	4, 649

Arsenic compounds exported from the United States, 1928–1931 [1]

Year	Calcium arsenate		Lead arsenate	
	Pounds	Value	Pounds	Value
1928	1, 178, 702	$67, 151	1, 093, 673	$141, 235
1929	3, 139, 633	171, 123	1, 563, 982	192, 185
1930	3, 177, 335	166, 647	2, 270, 980	263, 603
1931	2, 145, 653	101, 168	1, 788, 345	176, 212

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[1] Not separately recorded prior to 1928.

ASBESTOS

Asbestos sold or used by producers in the United States, 1927–1931, by varieties

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	(1)	(1)	(1)	(1)	2,981	$336,882
1928	(1)	(1)	(1)	(1)	2,239	351,178
1929	1,983	$317,584	1,172	$33,420	3,155	351,004
1930	3,653	273,292	589	15,992	4,242	289,284
1931	2,857	111,708	371	7,259	3,228	118,967

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(1) Bureau of Mines not at liberty to publish figures.

Asbestos (unmanufactured) imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1927	223,693	$8,150,340	309	$48,774
1928	230,595	9,017,891	850	346,632
1929	262,427	11,153,017	709	108,467
1930	208,681	7,064,824	771	95,318
1931	136,361	3,749,340	1,714	122,391

ASPHALT AND RELATED BITUMENS

Native asphalt and related bitumens sold at mines in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	839,040	$5,605,850	1930	702,777	$4,463,092
1928	807,860	5,175,055	1931	503,383	2,930,451
1929	804,027	5,470,493			

Asphalt (including road oil), manufactured in the United States from petroleum, sold at refineries in 1927–1931

Year	From domestic petroleum		From foreign petroleum	
	Short tons	Value	Short tons	Value
1927	1,525,420	$19,019,150	2,426,030	$35,771,940
1928	1,859,725	21,529,229	2,298,848	30,056,866
1929	2,258,675	23,803,552	2,355,498	27,057,868
1930	2,167,068	20,851,354	1,986,926	21,181,467
1931	2,206,568	16,614,594	1,867,302	15,191,065

Asphalt and related bitumens imported for consumption in the United States, 1927–1931

Year	Crude asphalt		Ozokerite	
	Short tons	Value	Short tons	Value
1927	157, 982	$1, 138, 898	3, 800	$579, 118
1928	119, 560	864, 607	5, 451	594, 416
1929	121, 019	955, 606	4, 896	616, 617
1930	53, 198	457, 172	6, 237	722, 426
1931	73, 672	726, 217	4, 455	428, 808

Year	Ichthyol		Bituminous limestone		Total	
	Pounds	Value	Short tons	Value	Short tons	Value
1927	48, 199	$58, 821	118	$1, 500	161, 924	$1, 778, 337
1928	42, 610	60, 321	28	439	125, 060	1, 519, 783
1929	32, 529	42, 066			125, 931	1, 614, 289
1930	20, 980	29, 272			59, 445	1, 208, 870
1931	10, 462	15, 607			78, 132	1, 170, 632

Asphalt and related bitumens exported from the United States, 1927–1931

Year	Native asphalt and bitumens			Petroleum asphalt		Asphalt roofing	
	Unmanufactured		Manufactures of, except roofing	Short tons	Value	Squares (100 square feet)	Value
	Short tons	Value					
1927	39, 875	$1, 034, 334	$1, 248, 978	385, 031	$8, 325, 413	853, 842	$1, 150, 722
1928	26, 263	683, 563	770, 822	492, 362	9, 788, 501	934, 908	1, 251, 429
1929	46, 962	1, 133, 058	1, 280, 068	479, 404	8, 542, 975	829, 066	1, 102, 192
1930	23, 160	628, 673	1, 120, 091	410, 389	7, 277, 032	543, 426	688, 362
1931	18, 977	530, 822	578, 731	288, 099	4, 940, 611	335, 279	390, 538

BARITE AND BARIUM PRODUCTS

BARITE

Crude barite sold or used by producers in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	254, 265	$1, 670, 878	1930	234, 932	$1, 538, 171
1928	269, 544	1, 754, 924	1931	174, 520	994, 655
1929	277, 269	1, 850, 706			

Crude barite sold or used by producers in the United States, 1930 and 1931, by States

State	1930		1931	
	Short tons	Value	Short tons	Value
Arizona			2, 139	$14, 275
California	19, 517	$114, 310	17, 500	102, 085
Georgia	41, 746	230, 769	(1)	(1)
Missouri	132, 640	938, 812	93, 417	539, 152
Nevada	2, 647	19, 457	1, 400	9, 600
Tennessee	17, 006	111, 981	10, 170	62, 903
Virginia	10, 250	73, 168	(1)	(1)
Other States [2]	11, 126	49, 674	49, 894	266, 640
	234, 932	1, 538, 171	174, 520	994, 655

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[1] Included under "Other States."

[2] 1930: Figures cover South Carolina and Wisconsin; 1931: Georgia and Virginia.

Crude domestic and foreign barite used in the manufacture of barium products in the United States, 1927–1931, in short tons

Year	In manufacture of—		
	Ground barite	Lithopone	Barium chemicals
1927	73, 119	222, 791	34, 280
1928	74, 814	211, 592	48, 289
1929	58, 770	223, 188	52, 448
1930	69, 426	178, 944	76, 825
1931	35, 393	157, 181	72, 696

Crude barite imported for consumption in the United States, 1927–1931

Year	Short tons	Value
1927	70, 274	$253, 284
1928	61, 765	190, 756
1929	85, 729	284, 436
1930	52, 111	$179, 579
1931	73, 080	329, 114

Exports of barite are not separately recorded.

BARIUM PRODUCTS

Barium products, manufactured in the United States from either domestic or imported crude ore, sold or used by producers in 1927–1931, in short tons [1]

Product	1927	1928	1929	1930	1931
Ground barite	57, 658	64, 425	54, 472	55, 284	32, 297
Lithopone	176, 994	200, 468	206, 315	164, 065	151, 850
Barium chemicals:					
Carbonate	5, 969	7, 626	7, 902	5, 224	5, 687
Chloride	3, 708	5, 224	6, 545	(2)	(2)
Sulphate (blanc fixe)	13, 395	(2)	(2)	(2)	31, 151
Other [3]	871	21, 119	23, 991	26, 139	7, 341
	258, 595	298, 862	299, 225	250, 712	228, 326

[1] In order to avoid duplication of figures, barium chemicals manufactured from other barium chemicals bought in open market are not included in table.

[2] Included under "Other."

[3] Figures cover chemicals, as follows—1927: Binoxide, hydroxide, and sulphide; 1928 and 1929: Binoxide, hydroxide, sulphate, and sulphide; 1930: Binoxide, chloride, hydroxide, monoxide, oxide crystals, sulphate, and sulphide; 1931: Binoxide, chloride, oxide, and sulphide.

Barium products imported for consumption in the United States, 1927–1931

Year	Ground barite		Lithopone		Barium binoxide		Blanc fixe (precipitated barium sulphate)		Artificial barium carbonate (chemically precipitated)	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	3, 259	$38, 568	7, 979	$656, 166	6	$1, 264	2, 400	$107, 179	4, 918	$119, 014
1928	3, 098	33, 378	9, 885	808, 200	6	1, 310	3, 680	168, 923	5, 222	116, 241
1929	2, 924	34, 619	8, 409	725, 554	(1)	21	3, 501	168, 367	3, 206	69, 236
1930	2, 331	26, 905	7, 018	595, 597	(2)	28	2, 994	133, 260	2, 662	52, 427
1931	1, 851	22, 415	5, 674	428, 523	(3)	11	930	38, 083	1, 110	20, 839

Year	Natural barium carbonate (witherite)		Barium chloride		Barium nitrate		Barium hydroxide		Barium oxide	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	3, 300	$65, 821	1, 577	$45, 285	711	$65, 284	222	$12, 439	(4)	(4)
1928	4, 311	82, 434	1, 172	25, 253	789	69, 010	186	10, 031	(4)	(4)
1929	4, 376	99, 335	78	3, 049	615	56, 770	202	11, 809	(4)	(4)
1930	[5] 2, 562	[5] 52, 282	7	372	407	31, 985	220	12, 235	(4)	(4)
1931	[5] 2, 352	[5] 39, 964	6	201	423	29, 796	345	25, 570	221	$18, 870

[1] 133 pounds.
[2] 222 pounds.
[3] 122 pounds.
[4] Not separately recorded prior to 1931.
[5] Beginning June 18, 1930, imports recorded as "Witherite, crude, unground."

Lithopone exported from the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	2, 110	$222, 585	1930	3, 665	$380, 047
1928	3, 326	337, 565	1931	3, 821	341, 257
1929	4, 556	463, 235			

BAUXITE AND ALUMINUM

BAUXITE

Bauxite produced in the United States, 1927–1931

Year	Georgia, Alabama, and Tennessee		Arkansas		Total	
	Long tons	Value	Long tons	Value	Long tons	Value
1927	17, 110	$95, 920	303, 830	$1, 892, 860	320, 940	$1, 988, 780
1928	14, 190	80, 668	361, 236	2, 193, 230	375, 426	2, 273, 898
1929	14, 723	84, 480	351, 054	2, 181, 158	365, 777	2, 265, 638
1930	15, 339	104, 908	315, 273	1, 823, 389	330, 612	1, 928, 297
1931	9, 198	59, 179	186, 697	1, 081, 450	195, 895	1, 140, 629

Bauxite imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports (including bauxite concentrates)	
	Long tons	Value	Long tons	Value
1927	356, 580	$1, 572, 236	121, 858	$7, 800, 491
1928	350, 111	1, 534, 498	112, 984	5, 210, 912
1929	380, 812	1, 753, 840	133, 551	3, 926, 283
1930	409, 678	1, 995, 941	104, 504	3, 776, 774
1931	306, 490	1, 495, 577	88, 370	3, 309, 208

ALUMINUM

Aluminum produced in the United States, 1927–1931

Year	Primary metal		Secondary metal [1]	
	Pounds	Value	Pounds	Value
1927	160, 000, 000	$39, 266, 000	92, 400, 000	$23, 469, 600
1928	210, 000, 000	47, 899, 000	95, 600, 000	22, 848, 400
1929	225, 000, 000	51, 864, 000	96, 800, 000	23, 135, 200
1930	229, 035, 000	50, 961, 000	77, 200, 000	17, 177, 000
1931	177, 544, 000	37, 284, 000	60, 600, 000	12, 726, 000

[1] Value of secondary aluminum, 1927–1929, inclusive, based on average price at New York, as given by American Metal Market.

Aluminum imported for consumption in the United States, 1927–1931

Year	Crude and semicrude [1]		Manufactures of [2]	Total value
	Pounds	Value		
1927	62, 575, 222	$13, 316, 986	$884, 992	$14, 201, 978
1928	38, 847, 007	8, 057, 107	816, 368	8, 873, 475
1929	50, 880, 823	9, 934, 723	925, 286	10, 860, 009
1930	25, 461, 179	4, 689, 521	596, 063	5, 285, 584
1931	14, 832, 807	2, 539, 756	670, 989	3, 210, 745

[1] Includes crude aluminum, plates, sheets, wire, etc.
[2] Includes aluminum leaf, kitchen utensils, and all other manufactures of aluminum.

Aluminum exported from the United States, 1927–1931

Year	Crude and semicrude [1]		Manufactures of	Total value
	Pounds	Value		
1927	14, 522, 560	$3, 478, 649	[2] $2, 828, 772	$6, 307, 421
1928	15, 728, 281	3, 758, 728	[2] 3, 132, 762	6, 891, 490
1929	17, 032, 117	4, 149, 539	[2] 3, 821, 546	7, 971, 085
1930	17, 329, 511	3, 915, 582	[2] 3, 206, 272	7, 121, 854
1931	4, 700, 878	985, 870	[2] 1, 868, 875	2, 854, 745

[1] Includes ingots, metal and alloys, plates and sheets, etc.
[2] Tubes, moldings, castings, and other shapes exported amounted to 1,529,615 pounds in 1927, 1,003,957 pounds in 1928, 2,466,508 pounds in 1929, 1,864,308 pounds in 1930, and 1,292,400 pounds in 1931; figures for quantity of table, kitchen, or hospital utensils, and other manufactures exported are not recorded.

BISMUTH

The bismuth produced in the United States is a by-product obtained in the refining of lead and tin bullion, part of which is from ores of foreign origin. Figures of production are not available for publication.

Bismuth and "compounds, mixtures, and salts of bismuth" imported for consumption in the United States, 1927–1931

Year	Bismuth		Compounds, mixtures, and salts of bismuth	
	Pounds	Value	Pounds	Value
1927	47, 732	$100, 773	10, 560	$15, 080
1928	41, 383	77, 444	8, 168	16, 336
1929	37, 480	58, 853	3, 552	16, 645
1930	24, 405	20, 088	657	5, 083
1931	7, 718	8, 191	951	5, 318

Exports of bismuth are not separately recorded.

BORAX

[See Sodium salts (natural)]

BRIQUETS (FUEL)

Fuel briquets produced in the United States, 1927–1931

Year	Short tons	Value
1927	970, 468	$7, 985, 165
1928	947, 423	7, 705, 617
1929	1, 212, 415	9, 515, 205
1930	1, 028, 865	$8, 028, 736
1931	698, 316	5, 260, 585

Briquets and other composition coals for fuels imported for consumption in the United States, 1927–1931

Year	Short tons	Value
1927	60, 601	$314, 435
1928	71, 485	353, 168
1929	89, 458	458, 517
1930	73, 418	$399, 146
1931	60, 950	325, 189

BROMINE

Bromine and bromine in compounds sold or used by producers in the United States, 1927–1931

Year	Pounds	Value
1927	1, 756, 310	$564, 689
1928	2, 164, 000	649, 475
1929	6, 414, 620	1, 759, 325
1930	8, 462, 800	$2, 109, 974
1931	8, 935, 330	1, 854, 650

Imports of bromine have been as follows: 1931, 25 pounds, valued at $24; 1930, 1,123 pounds, $347; 1929, 17,573 pounds, $5,804. No imports were recorded for 1927 and 1928.

Exports are not specifically shown.

CADMIUM

Cadmium produced in the United States, 1927–1931

Year	Metallic cadmium		Cadmium compounds	
	Pounds	Value	Estimated cadmium content (pounds)	Value
1927	1, 074, 654	[1] $645, 000	229, 000	$191, 051
1928	1, 875, 896	1, 144, 297	239, 900	228, 013
1929	2, 481, 427	2, 009, 956	433, 300	498, 734
1930	2, 777, 762	1, 777, 768	316, 300	323, 718
1931	1, 050, 529	409, 706	337, 200	331, 119

[1] Value in 1927 based on the average market quotation of 60 cents a pound.

Metallic cadmium imported for consumption in the United States, 1927–1931

Year	Pounds	Value
1927	22, 400	$13, 172
1928	233, 101	128, 901
1929	214, 307	184, 527
1930	40, 105	$27, 915
1931	271	183

Exports of cadmium are not separately recorded.

CALCIUM CHLORIDE

Calcium-magnesium chloride, from natural brines, sold by producers in the United States, 1927–1931

Year	Short tons	Value
1927	95, 721	$1, 947, 797
1928	102, 090	1, 995, 603
1929	114, 240	2, 097, 061
1930	116, 160	$2, 207, 800
1931	86, 156	1, 687, 166

Calcium chloride imported for consumption in the United States, 1927–1931

Year	Short tons	Value
1927	6, 514	$85, 456
1928	9, 263	100, 223
1929	8, 236	113, 573
1930	6, 641	$95, 921
1931	4, 916	74, 546

Exports of calcium chloride were not separately recorded until 1929, when 15,425 short tons, valued at $362,658, were exported. Similar exports in 1930 were 21,350 tons, $513,577, and in 1931, 24,351 tons, $566,573.

CARBON BLACK

Carbon black produced from natural gas in the United States, 1927–1931

Year	Number of producers reporting	Carbon black produced		Natural gas used (estimate)
		Pounds	Value at plant	M cubic feet
1927	33	198, 429, 000	$10, 955, 000	144, 087, 000
1928	31	248, 790, 000	13, 782, 000	175, 137, 000
1929	35	366, 442, 000	18, 720, 000	261, 107, 000
1930	33	379, 942, 000	14, 852, 000	266, 625, 000
1931	26	280, 907, 000	8, 621, 000	195, 396, 000

No carbon black is imported.

Carbon black exported from the United States 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	54, 430, 811	$4, 599, 734	1930	84, 260, 447	$5, 789, 458
1928	77, 903, 153	6, 794, 224	1931	96, 714, 116	5, 078, 838
1929	91, 829, 215	8, 270, 837			

CEMENT

Principal hydraulic cements shipped from mills in the United States, 1927–1931

Year	Masonry, natural, and puzzolan cements		Portland cement		Total	
	Barrels	Value	Barrels	Value	Barrels	Value
1927	2, 158, 323	$2, 881, 029	171, 864, 728	$278, 854, 647	174, 023, 051	$281, 735, 676
1928	2, 213, 645	2, 910, 097	175, 838, 332	275, 972, 945	178, 051, 977	278, 883, 042
1929	2, 159, 130	2, 950, 717	169, 868, 322	252, 153, 789	172, 027, 452	255, 104, 506
1930	1, 787, 016	2, 469, 531	159, 059, 334	228, 779, 756	160, 846, 350	231, 249, 287
1931	1, 226, 850	1, 619, 920	127, 150, 534	140, 959, 906	128, 377, 384	142, 579, 826

Portland cement produced in the United States, 1927–1931, in barrels

1927	173, 206, 513	1930	161, 197, 228
1928	176, 298, 846	1931	125, 429, 071
1929	170, 646, 036		

Portland cement produced, shipped, and in stock in the United States, 1930 and 1931, by States and districts

	Plants shipping		Production (barrels)		Shipments				Stock at mills (Dec. 31) (barrels)	
					1930		1931			
	1930	1931	1930	1931	Barrels	Value	Barrels	Value	1930	1931
STATE										
Alabama	6	6	4, 821, 141	4, 446, 902	4, 689, 516	$5, 829, 818	4, 476, 400	$5, 283, 085	653, 684	624, 186
California	12	10	10, 124, 219	7, 740, 168	10, 438, 479	15, 241, 089	7, 496, 080	11, 557, 442	859, 324	1, 103, 412
Illinois	4	4	7, 934, 563	6, 407, 191	7, 951, 680	10, 519, 162	6, 425, 909	5, 342, 446	1, 178, 037	1, 159, 319
Iowa	6	5	7, 088, 108	5, 804, 462	7, 035, 252	10, 107, 584	5, 790, 087	5, 453, 320	1, 400, 000	1, 414, 375
Kansas	7	7	6, 012, 360	4, 145, 195	5, 633, 098	8, 254, 416	4, 478, 823	4, 112, 809	1, 174, 773	841, 145
Michigan	14	14	11, 510, 895	6, 132, 768	10, 817, 994	14, 897, 439	7, 168, 720	6, 984, 725	3, 091, 414	2, 055, 462
Missouri	5	5	7, 808, 543	5, 666, 869	8, 030, 528	11, 470, 751	5, 103, 287	5, 052, 840	803, 852	1, 367, 434
New York	10	10	10, 372, 742	9, 486, 659	10, 256, 086	15, 380, 703	9, 833, 048	10, 638, 666	1, 640, 005	1, 293, 616
Ohio	10	10	8, 632, 062	6, 068, 958	8, 185, 077	11, 956, 038	6, 211, 789	6, 146, 302	1, 795, 919	1, 653, 088
Pennsylvania	27	27	37, 843, 662	28, 510, 231	37, 968, 647	52, 712, 176	28, 412, 975	30, 952, 302	5, 890, 777	5, 988, 033
Tennessee	6	6	3, 874, 549	3, 302, 720	3, 822, 598	5, 315, 693	3, 287, 966	3, 810, 271	527, 517	542, 271
Texas	9	9	6, 781, 502	6, 189, 137	6, 792, 346	10, 782, 444	6, 265, 016	8, 280, 913	801, 922	726, 043
Other States [1]	47	47	38, 392, 882	31, 527, 811	37, 438, 033	56, 312, 443	32, 200, 434	37, 344, 785	6, 081, 398	5, 408, 775
	163	160	161, 197, 228	125, 429, 071	159, 059, 334	228, 779, 756	127, 150, 534	140, 959, 906	25, 898, 622	24, 177, 159
DISTRICT										
Eastern Pennsylvania, New Jersey, and Maryland	25	25	35, 140, 880	28, 640, 435	35, 356, 917	49, 041, 368	28, 852, 931	31, 526, 293	5, 064, 120	4, 851, 624
New York and Maine	11	11	11, 341, 724	10, 309, 448	11, 121, 958	16, 877, 560	10, 740, 835	11, 733, 315	1, 774, 464	1, 343, 077
Ohio, western Pennsylvania, and West Virginia	19	19	17, 620, 488	11, 563, 606	17, 068, 119	24, 395, 914	11, 548, 414	11, 715, 773	3, 555, 614	3, 570, 806
Michigan	14	14	11, 510, 895	6, 132, 768	10, 817, 994	14, 897, 439	7, 168, 720	6, 984, 725	3, 091, 414	2, 055, 462
Wisconsin, Illinois, Indiana, and Kentucky	11	11	20, 232, 671	15, 174, 044	19, 571, 759	26, 995, 982	15, 938, 258	14, 607, 735	3, 596, 835	2, 832, 621
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	19	19	12, 880, 818	12, 306, 864	12, 728, 652	17, 664, 733	12, 310, 474	15, 285, 223	1, 799, 033	1, 795, 423
Eastern Missouri, Iowa, Minnesota, and South Dakota	12	11	16, 693, 905	12, 967, 590	16, 886, 039	24, 061, 001	12, 272, 390	11, 966, 314	2, 403, 117	3, 098, 317
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	13	13	12, 510, 599	9, 181, 849	11, 880, 424	17, 704, 859	9, 633, 404	9, 435, 048	2, 089, 303	1, 637, 748
Texas	9	9	6, 781, 502	6, 189, 137	6, 792, 346	10, 782, 444	6, 265, 016	8, 280, 913	801, 922	726, 043
Colorado, Montana, Utah, Wyoming, and Idaho	9	9	2, 268, 813	2, 215, 985	2, 375, 335	4, 657, 623	2, 060, 045	3, 299, 076	336, 269	492, 209
California	12	10	10, 124, 219	7, 740, 168	10, 438, 479	15, 241, 089	7, 496, 080	11, 557, 442	859, 324	1, 103, 412
Oregon and Washington	9	9	4, 090, 714	3, 007, 177	4, 021, 312	6, 459, 744	2, 863, 967	4, 568, 049	527, 207	670, 417
	163	160	161, 197, 228	125, 429, 071	159, 059, 334	228, 779, 756	127, 150, 534	140, 959, 906	25, 898, 622	24, 177, 159

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[1] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Hydraulic cement imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Barrels	Value	Barrels	Value
1927	2, 065, 730	$3, 007, 103	816, 726	$2, 796, 717
1928	2, 302, 475	3, 135, 558	824, 656	2, 938, 702
1929	1, 745, 345	1, 983, 974	885, 321	3, 083, 217
1930	984, 807	1, 154, 562	755, 778	2, 454, 515
1931	469, 598	535, 773	429, 653	1, 220, 600

CHROMITE

Chromite shipped from mines in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	[1] 201	[1] $5, 063	1930	80	$1, 905
1928	660	14, 807	1931	268	3, 509
1929	269	3, 976			

[1] No shipments reported by producers to the Bureau of Mines for 1927. Division of Mines and Mining, Department of Natural Resources, California, reports 225 short tons, valued at $5,063 f.o.b. shipping point, as sold in 1927.

Crude chromite imported for consumption in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	222, 360	$1, 748, 598	1930	326, 617	$3, 513, 123
1928	216, 592	1, 704, 988	1931	212, 528	3, 314, 776
1929	317, 630	2, 666, 488			

There are no exports of chromite.

CLAY

Clay sold by producers in the United States, 1927–1931

Year	Kaolin or china clay and paper clay		Ball clay		Slip clay		Fire clay	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	454, 245	$3, 809, 834	119, 763	$913, 976	6, 137	$32, 264	2, 699, 761	$7, 719, 725
1928	496, 142	4, 088, 003	120, 878	984, 075	5, 699	30, 796	2, 785, 158	7, 480, 609
1929	518, 169	4, 281, 301	118, 190	987, 306	6, 369	38, 582	3, 178, 805	8, 107, 586
1930	533, 800	3, 893, 814	93, 488	739, 787	4, 398	26, 465	2, 547, 162	6, 070, 663
1931	443, 300	2, 946, 953	83, 007	639, 798	1, 916	13, 613	1, 473, 161	3, 741, 038

Year	Stoneware clay		Bentonite [1]		Miscellaneous clay [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	98, 355	$203, 648	(1)	(1)	470, 915	$1,017,712	3, 849, 176	$13, 697, 159
1928	95, 626	207, 275	(1)	(1)	522, 829	1, 409, 981	4, 026, 332	14, 200, 739
1929	87, 456	181, 901	(1)	(1)	438, 031	1, 254, 068	4, 347, 020	14, 850, 744
1930	75, 832	146, 513	107, 405	$858, 927	600, 818	785, 326	3, 962, 903	12, 521, 495
1931	57, 466	131, 915	78, 815	472, 045	381, 830	406, 823	2, 519, 495	8, 352, 185

[1] Sales of bentonite included under "Miscellaneous clay" prior to 1930, when separate figures first became available.

Clay imported for consumption in the United States, 1927–1931

Year	Kaolin or china clay		Common blue and Gross Almerode glass-pot clay		All other clays				Total	
					Unwrought		Wrought			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	339, 014	$2, 937, 113	3, 884	$39, 451	50, 017	$447, 888	1, 585	$24, 518	394, 500	$3, 448, 970
1928	307, 304	2, 962, 269	10, 259	90, 742	51, 163	429, 788	1, 653	23, 564	370, 379	3, 506, 363
1929	279, 981	2, 700, 296	28, 008	268, 011	49, 324	420, 689	12, 283	154, 158	369, 596	3, 543, 154
1930	236, 251	2, 197, 540	18, 900	154, 428	24, 883	209, 175	[1] 4, 984	[1] 143, 817	[1] 285, 018	[1] 2, 704, 960
1931	151, 426	1, 056, 393	15, 183	116, 446	15, 615	125, 326	[1] 8, 376	[1] 237, 859	[1] 190, 600	[1] 1, 536, 024

[1] Includes "clays or earths, artificially activated with acid or other material," as follows: 1930 (June 18 to Dec. 31), 2,663 short tons, valued at $100,779; 1931, 4,912 tons, $184,381; not separately recorded prior to change in tariff.

Domestic clay exported from the United States, 1927–1931

Year	Fire clay		All other		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	48, 106	$392, 327	51, 278	$725, 562	99, 384	$1, 117, 889
1928	60, 138	494, 241	60, 911	896, 350	121, 049	1, 390, 591
1929	76, 561	588, 770	76, 789	1, 117, 312	153, 350	1, 706, 082
1930	62, 660	519, 788	73, 870	1, 108, 586	136, 530	1, 628, 374
1931	45, 314	329, 112	61, 389	915, 743	106, 703	1, 244, 855

CLAY PRODUCTS

Value of clay products of the United States, 1927–1931 [1]

Year	Brick and tile	Pottery	Total
1927	$292, 322, 616	$111, 612, 931	$403, 935, 547
1928	265, 770, 513	107, 780, 369	373, 550, 882
1929	261, 390, 174	112, 019, 217	373, 409, 391
1930	$189, 553, 239	$85, 581, 083	$275, 134, 322
1931	110, 979, 524	66, 582, 501	177, 562, 025

[1] Figures obtained through cooperation with Bureau of the Census.

Clay products of the United States, 1930 and 1931, by products [1]

Product	1930		1931	
	Quantity	Value	Quantity	Value
Common brick ... thousands	3, 631, 436	$37, 432, 814	2, 314, 664	$21, 652, 130
Face brick ... do	1, 481, 825	24, 614, 992	903, 226	13, 271, 068
Fancy or ornamental brick ... do	(2)	(2)	10, 317	445, 479
Enameled brick ... do	13, 402	940, 774	8, 605	484, 339
Hollow brick ... do	12, 063	134, 869	6, 175	58, 266
Terra cotta ... short tons	96, 396	10, 016, 166	54, 706	5, 491, 609
Hollow building tile ... do	2, 793, 853	16, 867, 085	1, 806, 235	9, 543, 778
Tile (other than hollow and drain)		23, 934, 451		19, 699, 609
Flue lining ... short tons	(2)	(2)	85, 718	838, 985
Conduit ... do	354, 152	5, 351, 797	121, 423	1, 628, 028
Vitrified brick or block ... thousands	299, 865	6, 246, 967	207, 386	4, 266, 406
Draintile ... short tons	675, 276	5, 011, 653	253, 308	1, 666, 970
Sewer pipe ... do	1, 270, 527	15, 963, 712	823, 303	9, 448, 473
Stove lining ... do	9, 386	329, 665	8, 877	316, 600
Fire brick:				
Standard ... thousands	738, 934	29, 737, 369	416, 041	15, 685, 507
Special shapes ... short tons	191, 539	4, 724, 184	126, 811	3, 068, 302
High-alumina ... thousands	11, 833	1, 592, 390	7, 020	733, 579
Glass-house tank blocks, melting pots, etc ... short tons	34, 417	1, 953, 644	22, 853	1, 258, 546
Wall coping ... do	33, 638	389, 936	13, 098	148, 654
Chimney pipe and tops ... do	7, 295	160, 718	4, 151	134, 127
Segment blocks ... do	46, 096	590, 588	(2)	(2)
Miscellaneous		3, 559, 465		1, 139, 069
Total brick and tile		189, 553, 239		110, 979, 524
Total pottery		85, 581, 083		66, 582, 501
Grand total		275, 134, 322		177, 562, 025

[1] Figures obtained through cooperation with Bureau of the Census.

[2] Value included under "Miscellaneous."

Value of clay products of the United States, 1930 and 1931, by States [1]

State	1930				1931			
	Number of firms reporting	Brick and tile	Pottery	Total	Number of firms reporting	Brick and tile	Pottery	Total
Alabama	40	$2, 288, 381	$6, 953	$2, 295, 334	29	(2)	(2)	$1, 441, 345
Arizona	8	236, 653	------------	236, 653	4	$154, 479	------------	154, 479
Arkansas	10	1, 074, 103	------------	1, 074, 103	8	(2)	(2)	494, 494
California	119	12, 904, 933	3, 304, 504	16, 209, 437	98	8, 040, 741	$2, 293, 776	10, 334, 517
Colorado	40	2, 131, 347	354, 337	2, 485, 684	37	(2)	(2)	1, 804, 526
Connecticut	20	(2)	(2)	1, 547, 524	24	(2)	(2)	1, 271, 557
Delaware	7	157, 391	------------	157, 391	3	(2)	------------	(2)
District of Columbia	4	(2)	(2)	298, 441	4	(2)	(2)	(2)
Florida	11	(2)	(2)	137, 543	6	(2)	(2)	38, 228
Georgia	33	2, 426, 222	13, 028	2, 439, 250	21	(2)	(2)	1, 126, 989
Idaho	4	122, 710	------------	122, 710	4	94, 139	------------	94, 139
Illinois	125	13, 345, 971	4, 174, 459	17, 520, 430	99	6, 520, 949	3, 836, 259	10, 357, 208
Indiana	92	9, 526, 595	2, 506, 257	12, 032, 852	60	4, 594, 023	1, 358, 214	5, 952, 237
Iowa	47	(2)	(2)	4, 671, 487	35	(2)	(2)	2, 276, 182
Kansas	26	(2)	(2)	2, 315, 005	15	(2)	(2)	1, 268, 896
Kentucky	38	(2)	(2)	5, 563, 392	36	(2)	(2)	3, 025, 934
Louisiana	16	(2)	(2)	375, 750	13	(2)	(2)	262, 326
Maine	14	459, 406	------------	459, 406	10	342, 096	------------	342, 096
Maryland	26	(2)	(2)	3, 513, 008	22	(2)	(2)	2, 587, 535
Massachusetts	33	1, 474, 406	244, 384	1, 718, 790	26	(2)	(2)	1, 763, 114
Michigan	34	(2)	(2)	4, 891, 647	28	(2)	(2)	3, 417, 585
Minnesota	17	(2)	(2)	1, 647, 007	11	(2)	(2)	1, 137, 737
Mississippi	23	583, 995	29, 355	613, 350	13	(2)	(2)	329, 440
Missouri	49	(2)	(2)	12, 517, 707	44	(2)	(2)	6, 442, 039
Montana	9	295, 513	------------	295, 513	9	135, 803	------------	135, 803
Nebraska	16	(2)	(2)	496, 714	14	(2)	(2)	386, 951
Nevada	1	(2)	------------	(2)	1	(2)	------------	(2)
New Hampshire	14	928, 138	------------	928, 138	10	349, 508	------------	349, 508
New Jersey	116	14, 642, 080	14, 456, 246	29, 098, 326	107	8, 643, 860	11, 257, 406	19, 901, 266
New Mexico	4	181, 117	------------	181, 117	4	(2)	(2)	123, 008
New York	79	8, 268, 377	6, 569, 053	14, 837, 430	68	6, 919, 062	4, 653, 336	11, 572, 398
North Carolina	56	1, 673, 773	40, 531	1, 714, 304	40	1, 113, 961	40, 771	1, 154, 732
North Dakota	5	160, 838	------------	160, 838	3	76, 085	------------	76, 085
Ohio	335	36, 107, 758	25, 341, 797	61, 449, 555	274	21, 905, 174	17, 514, 416	39, 419, 590
Oklahoma	21	(2)	(2)	941, 365	12	(2)	------------	(2)
Oregon	18	(2)	(2)	393, 955	16	(2)	(2)	268, 821
Pennsylvania	242	30, 989, 506	7, 347, 204	38, 336, 710	217	17, 566, 785	5, 886, 442	23, 453, 227
Rhode Island	1	(2)	------------	(2)	1	(2)	------------	(2)
South Carolina	21	785, 982	6, 779	792, 761	19	(2)	(2)	407, 855
South Dakota	2	(2)	------------	(2)	------	------------	------------	------------
Tennessee	25	(2)	(2)	1, 915, 224	25	1, 153, 117	850, 015	2, 003, 132
Texas	48	3, 876, 251	131, 607	4, 007, 858	49	2, 011, 984	106, 965	2, 118, 949
Utah	11	(2)	(2)	732, 608	8	(2)	(2)	329, 051
Vermont	1	(2)	------------	(2)	2	(2)	------------	(2)
Virginia	40	(2)	(2)	2, 380, 100	32	(2)	(2)	1, 400, 728
Washington	29	2, 364, 542	36, 240	2, 400, 782	22	1, 483, 015	20, 223	1, 503, 238
West Virginia	39	3, 374, 996	12, 579, 199	15, 954, 195	35	2, 727, 508	11, 371, 886	14, 099, 394
Wisconsin	32	(2)	(2)	2, 778, 533	27	(2)	(2)	1, 709, 048
Wyoming	6	177, 445	------------	177, 445	4	(2)	------------	(2)
Undistributed	------	38, 994, 810	8, 439, 150	316, 950	------	27, 147, 235	7, 392, 792	1, 226, 638
	2, 007	189, 553, 239	85, 581, 083	275, 134, 322	1, 649	110, 979, 524	66, 582, 501	177, 562, 025

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[1] Figures obtained through cooperation with Bureau of the Census.

[2] Included under "Undistributed."

Value of clay products imported for consumption in the United States, 1927–1931

Year	Pottery								Brick, fire brick, tile, and miscellaneous clay products	Grand total
	Brown earthen and common stoneware [1]	Tobacco pipes and pipe bowls of clay	Earthenware and crockery composed of a nonvitrified absorbent body		China and porcelain		Sanitary earthenware, decorated and not decorated	Total		
			Not decorated	Decorated	Not decorated	Decorated				
1927	$209, 736	$10, 327	$458, 141	$7, 320, 731	$578, 499	$11,875,202	$4, 950	$20, 457, 586	$1,849,355	$22, 306, 941
1928	155, 539	11, 575	389, 332	6, 085, 149	476, 275	9, 338, 946	6, 626	16, 463, 442	1, 955, 629	18, 419, 071
1929	139, 864	8, 969	342, 803	7, 599, 715	522, 102	9, 443, 385	5, 990	18, 062, 828	1, 940, 347	20, 003, 175
1930	93, 758	5, 650	166, 136	6, 243, 954	478, 770	7, 649, 549	39, 444	14, 677, 261	791, 204	15, 468, 465
1931	64, 432	3, 685	87, 023	3, 229, 309	194, 283	4, 243, 192	37, 853	7, 859, 777	424, 999	8, 284, 776

[1] Including Rockingham ware and miscellaneous pottery products.

Value of clay products of domestic manufacture exported from the United States, 1927–1931

Year	Building brick and hollow tile	Fire brick	Wall and floor tile	Earthen and stoneware	China	Sanitary earthenware	Electric porcelain	All other	Total
1927	$161, 346	$3, 024, 156	$391, 190	$862, 396	$338, 955	$1,198,660	$1, 201, 481	$108, 857	$7, 287, 041
1928	263, 786	3, 543, 735	298, 494	817, 381	389, 675	1, 371, 005	1, 375, 764	110, 012	8, 169, 852
1929	552, 687	4, 633, 121	529, 706	1, 025, 835	392, 582	1, 799, 378	1, 818, 455	284, 744	11, 036, 508
1930	399, 376	3, 674, 278	555, 765	831, 043	350, 291	1, 376, 952	1, 428, 159	319, 680	8, 935, 544
1931	320, 139	1, 798, 345	275, 551	216, 426	207, 633	577, 197	1, 148, 325	575, 324	5, 118, 940

COAL

Coal produced in the United States, 1927–1931

Year	Pennsylvania anthracite		Bituminous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	80, 095, 564	$420, 941, 726	517, 763, 352	$1, 029, 657, 000	597, 858, 916	$1, 450, 599, 000
1928	75, 348, 069	393, 637, 690	500, 744, 970	933, 774, 000	576, 093, 039	1, 327, 412, 000
1929	73, 828, 195	385, 642, 751	534, 988, 593	952, 781, 000	608, 816, 788	1, 338, 424, 000
1930	69, 384, 837	354, 574, 191	467, 526, 299	795, 483, 000	536, 911, 136	1, 150, 057, 000
1931	59, 645, 652	296, 354, 586	382, 089, 396	588, 895, 000	441, 735, 048	885, 250, 000

Coal produced in the United States, 1930 and 1931, by States

[Exclusive of product of wagon mines]

State	1930		1931	
	Short tons	Value	Short tons	Value
Alabama	15, 570, 058	$31, 616, 000	11, 998, 781	$21, 866, 000
Alaska	120, 100	631, 000	105, 900	556, 000
Arizona	9, 084	29, 000	7, 120	42, 000
Arkansas	1, 533, 434	5, 153, 000	1, 153, 555	3, 511, 000
California, Idaho, Nevada,[1] and Oregon	18, 538	100, 000	17, 385	88, 000
Colorado	8, 196, 910	21, 485, 000	6, 604, 369	15, 944, 000
Georgia	7, 092	18, 000	21, 580	45, 000
Illinois	53, 731, 230	93, 484, 000	44, 303, 295	75, 527, 000
Indiana	16, 489, 962	26, 178, 000	14, 295, 165	20, 735, 000
Iowa	3, 892, 571	10, 385, 000	3, 388, 355	8, 575, 000
Kansas	2, 429, 929	5, 231, 000	1, 986, 870	3, 771, 000
Kentucky	51, 208, 995	76, 186, 000	39, 963, 621	50, 745, 000
Maryland	2, 270, 593	3, 690, 000	2, 005, 773	2, 907, 000
Michigan	661, 113	2, 323, 000	359, 403	1, 094, 000
Missouri	3, 853, 150	8, 967, 000	3, 620, 497	7, 248, 000
Montana	3, 022, 004	6, 043, 000	2, 378, 052	4, 299, 000
New Mexico	1, 969, 433	6, 017, 000	1, 552, 822	4, 597, 000
North Carolina	28, 500	100, 000	2, 363	9, 000
North Dakota	1, 700, 157	2, 768, 000	1, 519, 307	2, 155, 000
Ohio	22, 551, 978	31, 643, 000	20, 410, 995	25, 371, 000
Oklahoma	2, 793, 954	7, 768, 000	1, 908, 394	4, 614, 000
Pennsylvania, bituminous	124, 462, 787	213, 584, 000	97, 658, 698	155, 060, 000
South Dakota	12, 810	31, 000	27, 485	64, 000
Tennessee	5, 130, 428	8, 417, 000	4, 721, 548	6, 942, 000
Texas	833, 872	1, 307, 000	716, 020	1, 070, 000
Utah	4, 257, 541	10, 515, 000	3, 350, 044	7, 442, 000
Virginia	10, 907, 377	17, 520, 000	9, 698, 680	14, 060, 000
Washington	2, 301, 928	7, 439, 000	1, 846, 461	5, 800, 000
West Virginia	121, 472, 638	181, 722, 000	101, 473, 172	132, 762, 000
Wyoming	6, 088, 133	15, 133, 000	4, 993, 686	11, 996, 000
Total bituminous	467, 526, 299	795, 483, 000	382, 089, 396	588, 895, 000
Pennsylvania anthracite	69, 384, 837	354, 574, 191	59, 645, 652	296, 354, 586
Grand total	536, 911, 136	1, 150, 057, 000	441, 735, 048	885, 250, 000

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[1] No production reported from Nevada for 1930.

Coal produced in the United States, 1930 and 1931, by months, in short tons

Month	Pennsylvania anthracite		Bituminous	
	1930	1931	1930	1931
January	6, 996, 000	6, 183, 000	50, 414, 000	38, 949, 000
February	6, 120, 000	5, 400, 000	40, 060, 000	31, 737, 000
March	4, 524, 000	4, 754, 000	36, 230, 000	34, 226, 000
April	4. 887, 000	5, 709, 000	36, 318, 000	28, 777, 000
May	5, 911, 000	5, 013, 000	36, 413, 000	28, 613, 000
June	5, 152, 000	4, 552, 000	34, 145, 000	29, 491, 000
July	5, 624, 000	3, 960, 000	35, 158, 000	30, 103, 000
August	6, 153, 000	4, 324, 000	36, 117, 000	30, 858, 000
September	5, 261, 000	4, 362, 000	39, 126, 000	32, 255, 000
October	7, 531, 000	6, 561, 000	44, 714, 000	36, 075, 000
November	5, 176, 000	4, 149, 000	38, 609, 000	30, 426, 000
December	6, 050, 000	4, 679, 000	40, 222, 000	30, 579, 000
	69, 385, 000	59, 646, 000	467, 526, 000	382, 089, 000

Coal imported for consumption in the United States, 1927–1931

Year	Anthracite		Bituminous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	119, 030	$837, 033	548, 278	$2, 435, 212	667, 308	$3, 272, 245
1928	384, 707	2, 591, 041	547, 505	2, 402, 083	932, 212	4, 993, 124
1929	487, 172	3, 328, 838	495, 218	2, 157, 364	982, 390	5, 486, 202
1930	674, 812	4, 376, 315	238, 226	1, 134, 801	913, 038	5, 511, 116
1931	637, 682	4, 140, 857	209, 349	1, 059, 068	847, 031	5, 199, 925

Coal exported from the United States, 1927–1931

Year	Anthracite		Bituminous (exclusive of bunker coal)		Total (exclusive of bunker coal)		Bunker coal	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	3, 325, 507	$32, 927, 796	18, 011, 744	$71, 328, 924	21, 337, 251	$104, 256, 720	4, 565, 278	$22, 077, 203
1928	3, 336, 272	32, 656, 523	16, 164, 485	59, 464, 348	19, 500, 757	92, 120, 871	4, 294, 223	20, 558, 057
1929	3, 406, 369	32, 568, 523	17, 429, 298	65, 741, 852	20, 835, 667	98, 310, 375	4, 286, 519	19, 575, 095
1930	2, 551, 659	24, 508, 700	15, 877, 407	59, 185, 741	18, 429, 066	83, 694, 441	3, 496, 680	15, 696, 909
1931	1, 778, 308	17, 062, 261	12, 126, 299	43, 394, 561	13, 904, 607	60, 456, 822	2, 195, 089	9, 638, 593

COBALT

A small carload of cobalt-manganese ore was shipped from Rock Run, Ala., in 1931, but figures of production are not available for publication. This is the first domestic production of cobalt ore since 1921.

Cobalt ore, cobalt, cobalt oxide, and "other salts and compounds" of cobalt imported for consumption in the United States, 1927–1931

Year	Ore		Cobalt		Oxide		Other salts and compounds	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1927	60, 382	$3, 019	407, 198	$841, 442	369, 747	$703, 608	55, 127	$28, 681
1928	107, 498	25, 922	535, 817	1, 147, 574	364, 154	692, 753	68, 281	39, 993
1929	434, 443	51, 862	806, 640	1, 743, 465	475, 928	884, 873	64, 782	37, 548
1930	199, 642	18, 994	460, 251	984, 244	425, 881	769, 331	55, 303	24, 121
1931	83, 895	8, 453	164, 967	254, 520	321, 891	391, 479	46, 317	19, 363

COKE AND COKE-OVEN BY-PRODUCTS

COKE

Coke produced in the United States, 1927–1931

Year	Beehive		By-product		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	7, 207, 417	$30, 276, 775	43, 884, 726	$232, 043, 803	51, 092, 143	$262, 320, 578
1928	4, 492, 803	16, 318, 556	48, 313, 025	236, 515, 204	52, 805, 828	252, 833, 760
1929	6, 472, 019	22, 564, 424	53, 411, 826	256, 430, 168	59, 883, 845	278, 994, 592
1930	2, 776, 316	9, 513, 357	45, 195, 705	199, 623, 905	47, 972, 021	209, 137, 262
1931	1, 128, 337	3, 518, 601	32, 355, 549	158, 090, 123	33, 483, 886	161, 608, 724

Coke produced in the United States in 1931, by States and kinds

State	Beehive		By-product		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			2, 943, 143	$8, 023, 595	2, 943, 143	$8, 023, 595
Colorado	(1)	(1)	225, 760	(2)	[3] 225, 760	(2)
Connecticut			(1)	(1)	(1)	(1)
Illinois			2, 478, 984	14, 042, 457	2, 478, 984	14, 042, 457
Indiana			2, 757, 135	16, 431, 416	2, 757, 135	16, 431, 416
Kentucky			(1)	(1)	(1)	(1)
Maryland			817, 995	(2)	817, 995	(2)
Massachusetts			1, 150, 270	9, 061, 415	1, 150, 270	9, 061, 415
Michigan			2, 436, 630	11, 632, 284	2, 436, 630	11, 632, 284
Minnesota			440, 489	3, 521, 295	440, 489	3, 521, 295
Missouri			(1)	(1)	(1)	(1)
New Jersey			930, 912	(2)	930, 912	(2)
New York			3, 578, 311	22, 115, 932	3, 578, 311	22, 115, 932
Ohio			3, 932, 939	17, 588, 581	3, 932, 939	17, 588, 581
Pennsylvania	855, 527	$2, 419, 114	7, 524, 722	30, 039, 070	8, 380, 249	32, 458, 184
Rhode Island			(1)	(1)	(1)	(1)
Tennessee	17, 074	53, 362	83, 439	356, 285	100, 513	409, 647
Utah	(1)	(1)	146, 788	(2)	[3] 146, 788	(2)
Virginia	99, 305	364, 854			99, 305	364, 854
Washington	582	5, 054	30, 104	210, 728	30, 686	215, 782
West Virginia	113, 627	366, 090	1, 265, 039	2, 838, 554	1, 378, 666	3, 204, 644
Wisconsin			(1)	(1)	(1)	(1)
Combined States	42, 222	310, 127	1, 612, 889	10, 616, 635	1, 655, 111	10, 926, 762
Undistributed				11, 611, 876		11, 611, 876
	1, 128, 337	3, 518, 601	32, 355, 549	158, 090, 123	33, 483, 886	161, 608, 724

[1] Included under "Combined States."
[2] Included under "Undistributed."
[3] Figures cover by-product coke only; beehive coke included under "Combined States."

Coke produced in the United States, 1930 and 1931, by months, in short tons

Month	1930			1931		
	Beehive	By-product	Total	Beehive	By-product	Total
January	318, 000	4, 167, 100	4, 485, 100	144, 400	3, 082, 700	3, 227, 100
February	279, 000	3, 977, 200	4, 256, 200	144, 300	2, 889, 000	3, 033, 300
March	288, 700	4, 361, 400	4, 650, 100	132, 100	3, 246, 300	3, 378, 400
April	299, 600	4, 216, 800	4, 516, 400	96, 200	3, 136, 900	3, 233, 100
May	270, 100	4, 234, 800	4, 504, 900	83, 200	3, 116, 000	3, 199, 200
June	259, 800	3, 927, 500	4, 187, 300	77, 300	2, 706, 900	2, 784, 200
July	213, 100	3, 746, 700	3, 959, 800	67, 200	2, 560, 900	2, 628, 100
August	168, 300	3, 611, 100	3, 779, 400	61, 600	2, 435, 400	2, 497, 000
September	166, 900	3, 376, 100	3, 543, 000	68, 900	2, 303, 100	2, 372, 000
October	176, 600	3, 407, 800	3, 584, 400	93, 400	2, 381, 800	2, 475, 200
November	166, 300	3, 114, 000	3, 280, 300	87, 100	2, 269, 400	2, 356, 500
December	169, 900	3, 055, 200	3, 225, 100	72, 600	2, 227, 200	2, 299, 800
	2, 776, 300	45, 195, 700	47, 972, 000	1, 128, 300	32, 355, 600	33, 483, 900

Coke imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1927	168, 859	$1, 371, 568	806, 664	$5, 430, 704
1928	147, 701	1, 132, 855	1, 097, 666	7, 394, 531
1929	119, 724	1, 092, 235	1, 238, 035	7, 840, 368
1930	132, 674	1, 044, 020	1, 003, 866	6, 067, 318
1931	99, 968	648, 265	754, 302	4, 084, 968

COKE-OVEN BY-PRODUCTS

By-products from coke-oven operations in the United States in 1931 [1]

[Exclusive of screenings or breeze]

Product	Produced	Sold	
		Quantity	Value
Tar ... gallons	450, 856, 092	273, 164, 573	$12, 440, 567
Ammonia:			
Sulphate ... pounds	983, 614, 651	1, 007, 561, 803	12, 812, 422
Ammonia liquor (NH_3 content) ... do	39, 089, 088	37, 347, 144	1, 465, 998
Sulphate equivalent of all forms ... do	(1, 139, 971, 003)	(1, 156, 950, 379)	14, 278, 420
Gas:			
Distributed through city mains ... M cu. ft	[2] 524, 097, 485	161, 881, 123	49, 023, 725
Used in steel or affiliated plants ... do		132, 761, 886	14, 243, 420
Used under boilers, etc ... do		14, 274, 493	810, 673
Sold for industrial use ... do		19, 989, 961	3, 352, 095
			67, 429, 913
Light oil and derivatives:			
Crude light oil ... gallons	[3] 122, 529, 148	8, 739, 202	710, 106
Benzol, crude and refined ... do	14, 772, 297	14, 267, 081	2, 209, 839
Motor benzol ... do	61, 960, 025	61, 471, 006	7, 209, 157
Toluol, crude and refined ... do	11, 832, 932	12, 693, 294	3, 099, 452
Solvent naphtha ... do	3, 772, 025	3, 463, 950	591, 628
Xylol ... do	2, 028, 729	2, 074, 126	444, 850
Other light-oil products ... do	4, 163, 028	2, 007, 860	124, 928
			14, 389, 960
Naphthalene, crude and refined ... pounds	7, 622, 929	7, 360, 309	78, 946
Tar derivatives:			
Creosote oil—			
Distillate as such ... gallons	13, 740, 196	13, 686, 594	1, 218, 227
In coal-tar solution ... do	2, 551, 402	2, 141, 073	144, 402
Pitch of tar ... short tons	78, 983	4, 951	30, 247
Other tar derivatives	----------	----------	55, 032
Phenol ... gallons	94, 097	110, 352	29, 783
Other products [4]	----------	----------	97, 595
	----------	----------	110, 193, 092

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[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name excepting, however, phenol, and tar acids produced at Clairton, Pa., which are covered by report of United States Tariff Commission.

[2] Inclusive of gas wasted and gas used for heating retorts.

[3] Of the crude light oil 117,625,416 gallons refined on the premises to make the derived products listed.

[4] Carbolate, crude products, cyanogen, sodium prussiate, and sulphur.

COLUMBITE

[See Tantalum]

COPPER [1]

Summary of statistics of the copper industry in the United States, 1929–1931

	1929	1930	1931
Production of copper:			
Smelter output from domestic ores .... pounds ..	2,002,863,135	1,394,389,327	1,042,711,178
Mine production .... do	1,995,110,398	1,410,147,374	1,057,749,350
Refinery production of new copper—			
Electrolytic .... do	1,785,754,654	1,228,416,733	947,065,977
Lake .... do	185,300,917	142,985,522	105,222,177
Casting .... do	11,676,718	19,821,950	22,317,887
Total domestic .... do	1,982,732,289	1,391,224,205	1,074,606,041
Total domestic and foreign .... do	2,740,112,376	2,157,059,178	1,501,442,333
Total new and old copper .... do	3,993,000,000	3,091,000,000	2,195,000,000
Ore, old tailings, etc., produced:			
Copper ore, old tailings, etc .... short tons ..	68,421,853	47,381,509	34,048,510
Average yield of copper .... per cent ..	1.41	1.43	1.50
Copper-lead and copper-lead-zinc ores .. short tons ..	259,126	246,430	213,245
Average price per pound .... cents ..	17.6	13.0	9.1
General imports (unmanufactured) .... pounds ..	974,312,201	817,154,236	585,892,098
Exports of metallic copper [2] .... do	992,895,119	753,114,927	557,574,235
Withdrawn from total supply on domestic account:			
Total new copper .... pounds ..	1,778,585,415	1,265,016,702	902,065,193
Total new and old copper .... do	3,032,000,000	2,199,000,000	1,596,000,000
Stocks at end of year:			
Refined copper .... do	306,000,000	615,000,000	924,600,000
Blister and material in solution .... do	500,000,000	450,000,000	348,000,000
World production (smelter) .... do	4,197,600,000	3,474,484,000	3,004,900,000
Value of smelter production from domestic ores	$352,504,000	$181,271,000	$94,887,000

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[1] For prices of copper, see statement on p. A16.

[2] Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined copper for which figures are not separable from those for ore and concentrates; also exclusive of "Other manufactures of copper" for which figures for quantity are not recorded.

Copper produced in the United States from domestic ores, 1927–1931

[Smelter output, in pounds fine]

Year	Pounds	Value	Year	Pounds	Value
1927	1,684,040,983	$220,609,000	1930	1,394,389,327	$181,271,000
1928	1,825,900,393	262,930,000	1931	1,042,711,178	94,887,000
1929	2,002,863,135	352,504,000			

Copper produced in the United States from domestic ores, 1927–1931, by States

[Smelter output, in pounds fine]

State	1927	1928	1929	1930	1931
Alaska	56,489,214	40,541,968	39,867,940	36,380,038	23,233,034
Arizona	681,168,117	735,632,406	829,206,475	570,897,080	400,310,634
California	25,802,603	24,707,992	33,084,232	26,262,447	8,344,901
Colorado	8,006,801	10,262,083	10,519,784	12,943,857	9,028,517
Idaho	1,811,103	2,336,654	6,267,487	2,713,681	1,626,541
Michigan	195,135,199	179,104,311	185,300,917	142,985,522	105,222,177
Missouri	5,041	930	1,880	2,198	----------
Montana	225,208,853	251,046,415	299,894,853	198,795,883	173,910,101
Nevada	118,298,342	159,332,977	138,990,247	87,475,019	71,233,352
New Mexico	79,761,222	92,777,233	100,165,206	74,187,966	66,776,267
North Carolina	5,362,041	8,207,000	(1)	(1)	(1)
Oregon	484,652	375,049	739,151	229,753	9,332
Pennsylvania	2,149,182	5,013,868	3,581,393	3,061,174	843,956
Tennessee	14,498,951	16,374,261	(1)	(1)	(1)
Texas	25,460	432,968	393,740	165,731	514
Utah	267,705,597	298,375,465	325,965,289	205,769,698	161,023,199
Vermont	238,143	----------	752,200	(1)	----------
Washington	1,766,953	1,197,340	1,569,260	1,404,893	71,426
Wyoming	----------	2,575	4,305	29,356	9,545
Undistributed	123,509	178,898	26,558,776	31,085,031	21,067,682
	1,684,040,983	1,825,900,393	2,002,863,135	1,394,389,327	1,042,711,178

[1] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

Primary and secondary copper produced by regular refining plants in the United States and imported, 1927–1931, in pounds

	1927	1928	1929	1930	1931
Primary:					
Domestic [1]—					
Electrolytic	1, 520, 076, 181	1, 607, 120, 026	1, 785, 754, 654	1, 228, 416, 733	947, 065, 977
Lake	195, 135, 199	179, 104, 311	185, 300, 917	142, 985, 522	105, 222, 177
Casting	3, 740, 819	5, 573, 050	11, 676, 718	19, 821, 950	22, 317, 887
	1, 718, 952, 199	1, 791, 797, 387	1, 982, 732, 289	1, 391, 224, 205	1, 074, 606, 041
Foreign [1]—					
Electrolytic	605, 748, 329	693, 787, 036	756, 555, 087	765, 189, 037	426, 307, 093
Casting and best select	1, 063, 181	2, 023, 356	825, 000	645, 936	529, 199
Total refinery production of new copper	2, 325, 763, 709	2, 487, 607, 779	2, 740, 112, 376	2, 157, 059, 178	1, 501, 442, 333
Imports of refined copper	103, 279, 082	84, 730, 630	134, 014, 792	86, 210, 331	174, 449, 893
Total new refined copper made available	2, 429, 042, 791	2, 572, 338, 409	2, 874, 127, 168	2, 243, 269, 509	1, 675, 892, 226
Secondary:					
Electrolytic	168, 766, 566	191, 323, 029	331, 858, 103	279, 423, 370	156, 099, 339
Casting	41, 102, 000	41, 322, 776	2, 300, 000	1, 106, 114	28, 914
	209, 868, 566	232, 645, 805	334, 158, 103	280, 529, 484	156, 128, 253
	2, 638, 911, 357	2, 804, 984, 214	3, 208, 285, 271	2, 523, 798, 993	1, 832, 020, 479

[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation at this stage of manufacture is not possible.

In addition to their output of metallic copper, the regular refining companies produced bluestone having copper content as follows: 1927, 9,180,000 pounds; 1928, 11,326,000 pounds; 1929, 10,255,000 pounds; 1930, 9,419,000 pounds; 1931, 8,983,000 pounds.

Stocks of copper in the United States, January 1, 1928–1932, in pounds

Year	Refined copper	Blister and material in process of refining	Year	Refined copper	Blister and material in process of refining
1928	171, 000, 000	401, 000, 000	1931	615, 000, 000	450, 000, 000
1929	114, 000, 000	423, 000, 000	1932	924, 600, 000	348, 000, 000
1930	306, 000, 000	500, 000, 000			

New refined copper withdrawn from total year's supply on domestic account in the United States, 1927–1931, in pounds

	1927	1928	1929	1930	1931
Total supply of new copper	2, 429, 042, 791	2, 572, 338, 409	2, 874, 127, 168	2, 243, 269, 509	1, 675, 892, 226
Stocks at beginning of year	146, 000, 000	171, 000, 000	114, 000, 000	306, 000, 000	615, 000, 000
Total available supply	2, 575, 042, 791	2, 743, 338, 409	2, 988, 127, 168	2, 549, 269, 509	2, 290, 892, 226
Copper exported	981, 083, 572	1, 020, 799, 531	903, 541, 753	669, 252, 807	464, 227, 033
Stocks at end of year	171, 000, 000	114, 000, 000	306, 000, 000	615, 000, 000	924, 600, 000
	1, 152, 083, 572	1, 134, 799, 531	1, 209, 541, 753	1, 284, 252, 807	1, 388, 827, 033
Withdrawn on domestic account	1, 422, 959, 219	1, 608, 538, 878	1, 778, 585, 415	1, 265, 016, 702	902, 065, 193

Copper (in unmanufactured form) imported for consumption in the United States, 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	718, 322, 990	$84, 769, 961	1930	817, 154, 684	$104, 377, 768
1928	787, 081, 063	97, 965, 353	1931	585, 900, 748	48, 627, 087
1929	974, 076, 610	153, 414, 829			

Copper (unmanufactured) imported into the United States in 1931, in pounds [1]

[General imports]

Country	Ore (copper content)	Concentrates (copper content)	Regulus, black or coarse copper, and cement copper (copper content)	Unrefined black blister and converter copper in pigs or converter bars	Refined in ingots, plates, or bars	Old and scrap copper fit only for remanufacture, and scale and clippings	Composition metal, copper chief value
Africa:							
British (Union of South)	124, 989	1, 152, 754	-----	119, 590	-----	-----	-----
Portuguese (Mozambique)	10, 970	18, 735, 667	-----	2, 072, 034	-----	-----	-----
Australia	-----	-----	572, 126	4, 275, 476	-----	-----	-----
Canada	5, 890	33, 864, 502	-----	39, 291, 472	83, 688, 691	4, 026, 929	-----
Chile	16, 687, 873	1, 793, 864	544, 487	61, 080, 468	90, 494, 303	29, 047	-----
Cuba	1, 217, 106	19, 778, 350	-----	-----	-----	142, 887	-----
France	239, 211	19, 513	49, 116	5, 875	-----	-----	-----
Germany	904, 234	110, 555	56, 234	12, 140	-----	91, 234	245
Mexico	881, 741	22, 184, 129	-----	87, 158, 095	-----	12, 568	-----
Peru	1, 157, 271	515, 247	34, 544	87, 381, 811	264, 659	-----	-----
Spain	24, 300	-----	144, 646	-----	-----	-----	-----
United Kingdom	1, 796, 060	-----	26, 685	2, 240	2, 240	32, 548	28
Venezuela	112, 294	1, 169, 990	-----	-----	-----	91, 501	-----
Other	418, 207	83, 602	41, 500	451, 733	-----	673, 629	32, 998
	23, 580, 146	99, 408, 173	1, 469, 338	281, 850, 934	174, 449, 893	5, 100, 343	33, 271
Total value	$1, 683, 438	$7, 146, 208	$112, 908	$24, 055, 221	$15, 348, 574	$277, 891	$2, 155

[1] "Copper manufactures, n. e. s.," imported valued at $118,194; quantity not recorded.

Copper exported from the United States, 1927–1931 [1]

Year	Pounds	Value	Year	Pounds	Value
1927	1, 076, 729, 246	$149, 114, 730	1930	753, 294, 022	$104, 316, 175
1928	1, 125, 019, 417	168, 525, 383	1931	557, 873, 744	54, 230, 992
1929	998, 474, 549	181, 684, 409			

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[1] Exclusive of "Other manufactures of copper," valued at $1,098,886 in 1927, $1,296,996 in 1928, $1,720,363 in 1929, $1,025,875 in 1930, and $516,818 in 1931, for which quantity is not recorded.

Copper exported from the United States in 1931, in pounds

Country	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined		Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Other copper manufactures
		Bars, ingots, or other forms	Rods						
Belgium		24, 389, 256	9, 876, 121	2, 118, 597	3, 577			28, 363	(1)
Canada	23, 299	7, 119, 358	7, 067, 663	816, 916	1, 677, 421	816, 223	157, 813	950, 188	
China		4, 723, 440			271	7, 639	206, 765	170, 407	
Denmark		2, 262, 902	1, 792, 728		131	2, 308	424, 836	21, 333	
France		109, 480, 532	2, 713, 999	7, 867, 026	1, 829	67, 691	7, 125	28, 670	
Germany	62, 237	58, 283, 390	482, 536	37, 910, 268	279		71, 179	5, 353	
India (British)		1, 673, 969	2, 223, 074	604, 683	71	1, 389, 962	159, 999	215, 269	
Italy		42, 902, 244	22, 943	381, 975		907, 998	3, 951	28, 482	
Japan	2, 009	188, 000	44, 811	2, 502, 472	1, 580	2, 319	2, 939	62, 880	
Netherlands		17, 845, 987	7, 386, 440	6, 672, 853	1, 241	347, 279	194	38, 904	
Norway		465, 788	1, 633, 380	22, 305	85		1, 718	16, 029	
Soviet Russia in Europe		7, 744, 019		1, 255, 762	5, 095			10, 403	
Spain		112, 030		1, 429, 652	10, 148	1, 701	2, 590	37, 495	
Sweden		28, 859, 373		56, 934	134	155	404	3, 445	
United Kingdom	209, 016	94, 249, 265	21, 857, 777	5, 452, 948	10, 094	589, 102	348, 224	1, 090, 212	
Other	2, 948	5, 096, 579	3, 729, 429	84, 621	358, 863	404, 856	4, 880, 481	10, 586, 487	
	299, 509	405, 396, 132	58, 830, 901	67, 177, 012	2, 070, 819	4, 537, 233	6, 268, 218	13, 293, 920	(1)
Total value	$24, 265	$38, 098, 529	$6, 178, 277	$5, 497, 814	$414, 769	$644, 772	$804, 592	$2, 567, 974	$516, 818

[1] Figures for quantity not recorded.

CORUNDUM

[See Abrasive materials]

CRYOLITE

No natural cryolite is produced in the United States, the entire supply in this country being imported from Greenland.

Cryolite imported for consumption in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	5, 064	$410, 876	1930	8, 315	$695, 794
1928	6, 906	529, 176	1931	7, 908	580, 621
1929	7, 778	670, 841			

DIATOMITE (INFUSORIAL EARTH)

[See Abrasive materials]

EMERY

[See Abrasive materials]

FELDSPAR

Crude feldspar sold or used by producers in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	202, 497	$1, 424, 755	1930	171, 788	$1, 066, 636
1928	210, 811	1, 418, 975	1931	147, 119	861, 059
1929	197, 699	1, 276, 640			

Feldspar imported for consumption in the United States, 1927–1931

Year	Crude		Crushed or ground	
	Long tons	Value	Long tons	Value
1927	27, 424	$206, 856	(1)	$3
1928	27, 857	224, 920	49	1, 091
1929	29, 927	241, 852	3	131
1930	21, 006	167, 157	51	586
1931	10, 719	95, 096	71	1, 500

[1] 250 pounds.

There is no record of exports of feldspar and if any feldspar is exported the quantity is doubtless negligible.

FERRO-ALLOYS

Ferro-alloys shipped from furnaces in the United States, 1927–1931, in long tons

Year	Ferromanganese	Spiegeleisen	Other varieties	Total	
				Quantity	Value
1927	291, 056	80, 892	274, 801	646, 749	$55, 163, 574
1928	310, 122	116, 911	367, 662	794, 695	66, 578, 039
1929	334, 162	123, 146	372, 016	829, 324	75, 506, 078
1930	273, 640	94, 918	281, 682	650, 240	51, 900, 220
1931	159, 168	55, 327	183, 800	398, 295	30, 764, 549

Ferro-alloys shipped from furnaces in the United States, 1930 and 1931

Variety of alloy	1930		1931	
	Long tons	Value	Long tons	Value
Ferromanganese	273, 640	$25, 865, 783	159, 168	$12, 999, 329
Spiegeleisen	94, 918	2, 469, 861	55, 327	1, 313, 068
Ferrosilicon (7 per cent or more silicon)	234, 328	10, 430, 720	153, 063	7, 213, 265
Ferrotungsten	736	1, 603, 903	870	1, 690, 298
Ferrovanadium	831	2, 244, 304	616	1, 613, 381
Other varieties [1]	45, 787	9, 285, 649	29, 251	5, 935, 208
	650, 240	51, 900, 220	398, 295	30, 764, 549

[1] Ferrochromium, ferromolybdenum and calcium-molybdenum compounds, ferrophosphorus, ferrotitanium, ferrozirconium, silicomanganese, silicospiegeleisen, and zirconium-ferrosilicon.

Value of ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1927–1931 [1]

1927	$4, 909, 292	1930	$5, 942, 162
1928	6, 215, 867	1931	2, 569, 484
1929	8, 669, 041		

[1] For items covered by values given, see following table.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1929–1931

Variety of alloy	1929		1930	
	Long tons	Value	Long tons	Value
Ferromanganese (manganese content) [1]	56, 969	$6, 126, 056	45, 001	$4, 128, 065
Spiegeleisen	13, 828	403, 853	13, 406	381, 197
Ferrochrome and chromium:				
Ferrochrome—				
Containing 3 per cent or more carbon (chromium content)	37	8, 835	----------	----------
Containing less than 3 per cent carbon	638	206, 311	153	31, 428
Chrome or chromium metal	21	5, 242	----------	----------
Ferrophosphorus	737	59, 961	1, 005	75, 917
Ferrosilicon (silicon content) [2]	9, 285	1, 388, 423	4, 541	623, 307
Molybdenum and ferromolybdenum (molybdenum content)	1	2, 384	65	283, 846
Titanium and ferrotitanium	7	2, 517	1	496
Tungsten and ferrotungsten (tungsten content)	211	376, 230	135	417, 906
Ferrovanadium	46	89, 229	----------	----------
	----------	8, 669, 041	----------	5, 942, 162

Variety of alloy	1931		
	Gross weight (long tons)	Content (long tons)	Value
Ferromanganese:			
Containing over 1 per cent carbon	24, 234	19, 488	$1, 713, 287
Containing not over 1 per cent carbon	430	348	38, 359
Manganese boron, manganese silicon, manganese metal, and spiegeleisen, n. e. s	(3)	431	44, 929
Spiegeleisen	9, 482	(3)	247, 788
Ferrochrome or ferrochromium containing less than 3 per cent carbon	135	91	21, 463
Ferrophosphorus	1, 839	(3)	134, 773
Ferrosilicon:			
Containing 8 per cent and less than 60 per cent silicon	3, 758	924	126, 509
Containing 60 per cent and less than 80 per cent silicon	25	20	1, 888
Chromium and zirconium silicon and calcium silicide	40	(3)	6, 629
Silicon aluminum, aluminum silicon	13	(3)	1, 800
Ferrosilicon aluminum and ferroaluminum silicon and alsimin	16	(3)	2, 149
Ferromolybdenum, molybdenum metal and powder, calcium molybdate, and other compounds and alloys of molybdenum	(3)	94	213, 660
Ferrotitanium	1	(3)	379
Tungsten and combinations, in lump, grains, or powder:			
Tungsten metal	(3)	9	11, 716
Combinations containing tungsten or tungsten carbide	(3)	(4)	24
Tungstic acid and other compounds of tungsten, n. s. p. f	(3)	1	3, 819
Ferrozirconium and zirconium-ferrosilicon	(5)	(3)	312
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[1] Includes small quantities of other manganese alloys.

[2] Includes small quantities of chromium and zirconium-silicon and calcium silicide.

[3] Not recorded.

[4] 3 pounds of tungsten.

[5] 496 pounds.

Ferro-alloys and ferro-alloy metals exported from the United States, 1927–1931

Variety of alloy	1927		1928		1929		1930		1931	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Ferromanganese	1, 641	$61, 793	9, 440	$232, 990	1, 574	$59, 036	6, 189	$145, 629	1, 306	$38, 506
Spiegeleisen										
Tungsten and ferrotungsten (including tungsten wire)	9	164, 917	7	123, 354	46	325, 133	13	221, 934	472	624, 412

FLUORSPAR

Fluorspar shipped from mines in the United States, 1927–1931

Year	Short tons	Value
1927	112, 546	$2, 034, 728
1928	140, 490	2, 656, 554
1929	146, 439	2, 791, 126
1930	95, 849	$1, 746, 643
1931	53, 484	931, 275

Fluorspar shipped from mines in the United States, 1930 and 1931, by States

State	1930		1931	
	Short tons	Value	Short tons	Value
Illinois	44, 134	$836, 473	28, 072	$468, 386
Kentucky	39, 181	763, 370	23, 462	437, 642
Colorado	9, 248	101, 758	529	5, 921
New Mexico	2, 312	45, 042	1, 026	19, 326
Nevada	974		395	
	95, 849	1, 746, 643	53, 484	931, 275

Fluorspar imported for consumption in the United States, 1927–1931

Year	Short tons	Value
1927	71, 242	$594, 082
1928	47, 450	409, 841
1929	54, 345	480, 999
1930	64, 731	$542, 249
1931	20, 709	211, 435

No exports of fluorspar have been reported by Bureau of Foreign and Domestic Commerce. Producers have reported exports, as follows:

Fluorspar reported by producers as exported from the United States, 1927–1931

Year	Short tons	Value
1927	385	$7, 507
1928	398	6, 586
1929	506	11, 621
1930	281	$6, 160
1931	311	5, 599

FULLER'S EARTH

Fuller's earth sold or used by producers in the United States, 1927–1931

Year	Number of operators	Short tons	Value
1927	16	264, 478	$3, 767, 038
1928	17	287, 012	3, 895, 991
1929	17	315, 983	4, 309, 723
1930	15	335, 644	$4, 326, 705
1931	22	288, 400	3, 055, 570

Fuller's earth imported for consumption in the United States, 1927–1931

Year	Short tons	Value
1927	7, 580	$109, 281
1928	7, 593	132, 003
1929	8, 302	152, 432
1930	7, 235	$156, 520
1931	4, 013	48, 964

Exports of fuller's earth are not separately recorded.

GARNET (ABRASIVE)

[See Abrasive materials]

GAS (NATURAL)

Natural gas produced in the United States and delivered to consumers, 1927–1931

[Value at point of consumption]

Year	M cubic feet	Value	Year	M cubic feet	Value
1927	1, 445, 428, 000	$317, 930, 000	1930	1, 943, 421, 000	$416, 090, 000
1928	1, 568, 139, 000	363, 726, 000	1931	1, 686, 436, 000	392, 816, 000
1929	1, 917, 693, 000	413, 276, 000			

Natural gas produced in the United States and delivered to consumers, 1930 and 1931, by States

[Value at point of consumption]

State	1930		1931	
	M cubic feet	Value	M cubic feet	Value
Arkansas	18, 585, 000	$3, 540, 000	13, 300, 000	$2, 696, 000
California	334, 789, 000	69, 071, 000	305, 930, 000	76, 345, 000
Colorado	3, 312, 000	958, 000	2, 536, 000	940, 000
Illinois	2, 890, 000	505, 000	2, 130, 000	999, 000
Indiana	1, 217, 000	676, 000	1, 337, 000	699, 000
Kansas	37, 630, 000	12, 459, 000	38, 742, 000	11, 498, 000
Kentucky	28, 023, 000	9, 691, 000	27, 870, 000	10, 151 000
Louisiana	278, 341, 000	35, 895, 000	224, 155, 000	37, 595, 500
Michigan	2, 075, 000	625, 000	472, 000	111, 000
Mississippi	179, 000	86, 000	6, 048, 000	1, 458, 000
Missouri	1, 064, 000	326, 000	1, 534, 000	685, 000
Montana	10, 060, 000	2, 990, 000	10, 949, 000	3, 299, 000
New Mexico	9, 497, 000	1, 273, 000	19, 354, 000	2, 401, 000
New York	9, 624, 000	6, 433, 000	7, 868, 000	5, 363, 000
Ohio	63, 394, 000	36, 491, 000	56, 326, 000	32, 061, 000
Oklahoma	348, 116, 000	47, 632, 000	263, 685, 000	32, 593, 000
Pennsylvania	88, 706, 000	44, 521, 000	74, 797, 000	37, 827, 000
South Dakota	98, 000	32, 000	12, 000	4, 000
Tennessee	24, 000	9, 000	25, 000	9, 000
Texas	517, 880, 000	71, 873, 000	464, 580, 000	73, 704, 600
Utah	393, 000	123, 000	(1)	(1)
West Virginia	144, 180, 000	66, 553, 000	124, 797, 000	58, 123, 000
Wyoming	43, 219, 000	4, 277, 000	39, 770, 000	4, 153, 500
Other [2]	125, 000	51, 000	219, 000	100, 400
	1, 943, 421, 000	416, 090, 000	1, 686, 436, 000	392, 816, 000

[1] Included under "Other."

[2] 1930: Alaska, Iowa, North Dakota, and Washington; 1931: Alaska, Utah, and Washington.

Natural gas imported into and exported from the United States, 1927–1931

Year	Imports		Exports (M cubic feet) [1]	Year	Imports		Exports (M cubic feet) [1]
	M cubic feet	Value			M cubic feet	Value	
1927			184, 000	1930	[2] 21, 000	(2)	1, 798, 000
1928			160, 000	1931	65, 088	$3, 255	2, 231, 000
1929			242, 000				

[1] As reported to Bureau of Mines. Not recorded by Bureau of Foreign and Domestic Commerce. Figures for value not available.

[2] As reported to Bureau of Mines. Not recorded by Bureau of Foreign and Domestic Commerce prior to 1931. Figures for value not available.

GASOLINE FROM NATURAL GAS

Natural gasoline produced in the United States, 1927–1931

Year	Natural gasoline produced		Natural gas treated (estimated) (M cubic feet)
	Gallons	Value at plant	
1927	1, 641, 144, 000	$118, 688, 000	1, 341, 248, 000
1928	1, 814, 034, 000	138, 944, 000	1, 473, 434, 000
1929	2, 233, 688, 000	158, 410, 000	1, 959, 294, 000
1930	2, 210, 494, 000	128, 160, 000	2, 088, 778, 000
1931	1, 831, 918, 000	63, 732, 000	1, 790, 119, 000

Natural gasoline produced in the United States, 1930 and 1931, by States

State	1930		1931	
	Gallons	Value	Gallons	Value
Alaska	39, 000	$5, 000	32, 000	$5, 000
Arkansas	30, 637, 000	1, 757, 000	26, 282, 000	921, 000
California	829, 713, 000	57, 974, 000	680, 339, 000	29, 505, 000
Colorado	1, 322, 000	69, 000	659, 000	21, 000
Illinois	6, 867, 000	420, 000	5, 024, 000	204, 000
Indiana	2, 000	(1)	1, 000	(1)
Kansas	35, 106, 000	1, 570, 000	32, 690, 000	935, 000
Kentucky	6, 641, 000	385, 000	5, 464, 000	266, 000
Louisiana	73, 693, 000	3, 725, 000	58, 034, 000	1, 731, 000
New Mexico	3, 663, 000	169, 000	17, 775, 000	419, 000
New York	208, 000	19, 000	132, 000	9, 000
Ohio	8, 937, 000	605, 000	5, 199, 000	271, 000
Oklahoma	591, 194, 000	29, 148, 000	454, 886, 000	12, 619, 000
Pennsylvania	16, 713, 000	1, 229, 000	14, 339, 000	706, 000
Texas	491, 299, 000	23, 596, 000	426, 695, 000	11, 887, 000
West Virginia	63, 328, 000	4, 151, 000	52, 844, 000	2, 436, 000
Wyoming	51, 132, 000	3, 338, 000	51, 523, 000	1, 797, 000
	2, 210, 494, 000	128, 160, 000	1, 831, 918, 000	63, 732, 000

(1) Less than $500.

No imports or exports of natural gasoline have been recorded by the Bureau of Foreign and Domestic Commerce. Natural gasoline is exported, but complete figures are not available.

GEMS AND PRECIOUS STONES

No figures of domestic output of gems and precious stones are available. Canvass was discontinued after 1923.

Value of diamonds and other precious stones and pearls imported for consumption in the United States, 1927–1931

Year	Diamonds				Other stones not set	Total, excluding pearls	Pearls
	Glazier's	Dust and bort	Rough or uncut	Cut but not set			
1927	$2, 148, 275	$62, 045	$11, 452, 439	$40, 714, 672	$4, 529, 350	$58, 906, 781	$6, 043, 162
1928	2, 756, 895	31, 222	11, 903, 815	42, 368, 172	3, 822, 140	60, 882, 244	7, 082, 034
1929	4, 067, 674	89, 363	9, 588, 137	41, 828, 581	9, 398, 183	64, 971, 938	10, 345, 420
1930	2, 756, 630	90, 945	5, 769, 566	23, 405, 415	3, 971, 095	35, 993, 651	2, 648, 042
1931	2, 400, 879	20, 292	3, 851, 698	11, 939, 291	1, 869, 140	20, 081, 300	1, 281, 019

Domestic exports are recorded as "Precious stones, including pearls," as follows: 1927, $87,291; 1928, $72,296; 1929, $47,316; 1930, $136,253; 1931, $44,284. Exports of foreign precious stones for 1927 to 1930 are recorded as "Precious stones and imitations," as follows: 1927, $62,494; 1928, $42,513; 1929, $41,845; 1930, $277,145. For 1931 they are recorded as "Foreign precious stones including pearls," $17,633.

GOLD AND SILVER[1]

Gold and silver produced in the United States, 1927–1931

Year	Gold		Silver	
	Troy ounces	Value	Troy ounces	Value
1927	2, 197, 125	$45, 418, 600	60, 434, 441	$34, 266, 328
1928	2, 233, 251	46, 165, 400	58, 462, 507	34, 200, 567
1929	2, 208, 386	45, 651, 400	61, 327, 868	32, 687, 754
1930	2, 285, 603	47, 247, 600	50, 748, 127	19, 538, 029
1931	2, 395, 878	49, 527, 200	30, 932, 050	8, 970, 294

[1] Gold is valued by law at $20.67+ a troy ounce. For prices of silver, see statement on p. A16.

Gold produced in the United States, 1930 and 1931, by States [1]

State	1930		1931	
	Troy ounces	Value [2]	Troy ounces	Value [2]
Alabama	10	$200	39	$800
Alaska	407, 356	8, 420, 800	466, 006	9, 633, 200
Arizona	148, 681	3, 073, 500	136, 805	2, 828, 000
California	450, 289	9, 308, 300	521, 158	10, 773, 300
Colorado	218, 258	4, 511, 800	225, 147	4, 654, 200
Georgia	203	4, 200	77	1, 600
Idaho	21, 198	438, 200	18, 058	373, 300
Montana	46, 900	969, 500	40, 901	845, 500
Nevada	140, 220	2, 898, 600	139, 194	2, 877, 400
New Mexico	31, 589	653, 000	31, 981	661, 100
North Carolina	498	10, 300	344	7, 100
Oregon	14, 300	295, 600	15, 301	316, 300
Pennsylvania	610	12, 600	237	4, 900
Philippine Islands	185, 208	3, 828, 600	182, 137	3, 765, 100
South Carolina	------------	------------	24	500
South Dakota	406, 297	8, 398, 900	431, 200	8, 913, 700
Tennessee	721	14, 900	397	8, 200
Texas	242	5, 000	------------	------------
Utah	208, 936	4, 319, 100	183, 462	3, 792, 500
Washington	3, 647	75, 400	3, 357	69, 400
Wyoming	440	9, 100	53	1, 100
	2, 285, 603	47, 247, 600	2, 395, 878	49, 527, 200

[1] Figures furnished by the Bureau of the Mint. [2] Gold value, $20.67+ a troy ounce.

Silver produced in the United States, 1930 and 1931, by States [1]

State	1930		1931	
	Troy ounces	Value [2]	Troy ounces	Value [2]
Alabama			6	$2
Alaska	392, 024	$150, 929	397, 949	115, 405
Arizona	4, 910, 394	1, 890, 502	4, 070, 860	1, 180, 549
California	1, 434, 126	552, 139	777, 025	225, 337
Colorado	4, 851, 571	1, 867, 855	2, 373, 706	688, 375
Georgia	23	9	11	3
Idaho	9, 710, 150	3, 738, 408	7, 416, 044	2, 150, 653
Illinois	1, 896	730		
Michigan	10, 720	4, 127	2, 024	587
Missouri	187, 548	72, 206	1, 800	522
Montana	8, 596, 966	3, 309, 832	4, 076, 872	1, 182, 293
Nevada	4, 178, 943	1, 608, 893	2, 368, 624	686, 901
New Mexico	1, 160, 374	446, 744	1, 070, 452	310, 431
North Carolina	32, 891	12, 663	20, 193	5, 856
Oregon	9, 816	3, 779	7, 487	2, 171
Pennsylvania	4, 538	1, 747	1, 604	465
Philippine Islands	120, 884	46, 540	110, 008	31, 902
South Dakota	105, 166	40, 489	113, 410	32, 889
Tennessee	85, 533	32, 930	41, 968	12, 171
Texas	468, 736	180, 463	241	70
Utah	14, 451, 266	5, 563, 738	8, 057, 015	2, 336, 534
Vermont	4, 512	1, 737		
Washington	29, 853	11, 493	24, 716	7, 168
Wyoming	197	76	35	10
	50, 748, 127	19, 538, 029	30, 932, 050	8, 970, 294

[1] Figures furnished by the Bureau of the Mint.

[2] Valued at average New York price of bar silver, as follows: 1930, 38.5 cents an ounce; 1931, 29 cents an ounce.

Value of gold and silver imported into and exported from the United States, 1927–1931

Year	Gold		Silver	
	Imports	Exports	Imports	Exports
1927	$207, 535, 195	$201, 455, 100	$55, 073, 917	$75, 624, 780
1928	168, 897, 307	560, 759, 341	68, 117, 329	87, 382, 016
1929	291, 648, 632	116, 582, 926	63, 939, 830	83, 407, 197
1930	396, 053, 695	115, 967, 332	42, 760, 841	54, 156, 584
1931	612, 119, 211	466, 794, 459	28, 664, 139	26, 485, 253

Value of gold and silver imported into and exported from the United States in 1931, by classes

	Imports	Exports	Excess of—	
			Imports	Exports
Gold:				
Contained in domestic ore and base bullion		$33, 354		$33, 354
Contained in foreign ore and base bullion	$32, 694, 434		$32, 694, 434	
Domestic bullion refined	55, 058, 583	385, 957, 242		330, 898, 659
Foreign bullion refined	111, 053, 605	5, 666	111, 047, 939	
United States coin	311, 766, 842	80, 783, 994	230, 982, 848	
Foreign coin	101, 545, 747	14, 203	101, 531, 544	
	612, 119, 211	466, 794, 459	476, 256, 765	330, 932, 013
Excess imports over exports			145, 324, 752	
Silver:				
Contained in domestic ore and base bullion		3, 380		3, 380
Contained in foreign ore and base bullion	11, 734, 914		11, 734, 914	
Domestic bullion refined	52, 350	21, 664, 216		21, 611, 866
Foreign bullion refined	11, 478, 777	2, 092, 870	9, 385, 907	
United States coin	3, 496, 197	51, 629	3, 444, 568	
Foreign coin	1, 901, 901	2, 673, 158		771, 257
	28, 664, 139	26, 485, 253	24, 565, 389	22, 386, 503
Excess imports over exports			2, 178, 886	

GRAPHITE

Natural graphite sold or used by producers in the United States, 1927–1931

Year	Amorphous		Crystalline	
	Short tons	Value	Pounds	Value
1927	2, 595	$35, 850	5, 224, 400	$197, 121
1928	2, 994	43, 320	5, 233, 300	253, 773
1929	3, 555	46, 650	5, 806, 410	264, 241
1930	1, 941	20, 525	(1)	(1)
1931	(1)	(1)	(1)	(1)

[1] Bureau of Mines not at liberty to publish figures.

Graphite imported for consumption in the United States, 1927–1931, by kinds [1]

Year	Amorphous		Crystalline chip or dust		Crystalline flake		Total [1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	9, 559	$146, 881	6, 116	$390, 822	1, 777	$186, 220	17, 452	$723, 923
1928	7, 699	107, 936	7, 143	452, 424	2, 727	241, 199	17, 569	801, 559
1929	12, 041	189, 198	8, 304	546, 668	3, 727	330, 968	24, 072	1, 066, 834
1930	10, 926	212, 614	3, 071	186, 616	2, 729	225, 438	16, 726	624, 668
1931	7, 048	148, 416	[2] 900	[2] 37, 357	1, 142	73, 986	9, 090	259, 759

[1] Imports of graphite crucibles were as follows: 1927, 2,583 crucibles, valued at $1,812; 1928, 2,368 crucibles, $1,245; 1929, 7,640 crucibles, $1,156; 1930, 25,976 crucibles, $3,218; and 1931, 350 crucibles, retorts, stoppers, and cones, $772; weight not recorded.

[2] Composed of 822 tons of lump and chip, valued at $32,823, and 78 tons of dust, valued at $4,534; not separately recorded for earlier years.

"Graphite and manufactures, except crucibles" exported from the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	1, 819	$435, 997	1930	1, 556	$418, 430
1928	2, 203	454, 770	1931	1, 188	248, 998
1929	1, 613	370, 013			

GRINDSTONES AND PULPSTONES

[See Abrasive materials]

GYPSUM

Gypsum produced in the United States and sold or used by producers, 1927–1931

Year	Crude produced (short tons)	Crude and calcined sold or used (total value)	Year	Crude produced (short tons)	Crude and calcined sold or used (total value)
1927	5, 346, 888	$42, 174, 454	1930	3, 471, 393	$27, 051, 484
1928	5, 102, 250	32, 036, 163	1931	2, 559, 017	20, 801, 357
1929	5, 016, 132	31, 292, 969			

Gypsum imported for consumption in the United States, 1927–1931

Year	Crude		Ground or calcined		Value of manufactured plaster of Paris	Keenes cement		Total value
	Short tons	Value	Short tons	Value		Short tons	Value	
1927	828,619	$1,167,581	8,650	$114,947	$89,096	655	$16,202	$1,387,826
1928	1,028,816	1,340,920	6,907	99,833	87,314	601	13,729	1,541,796
1929	1,036,385	1,060,874	4,979	69,703	71,479	430	11,327	1,213,383
1930	902,358	916,663	6,562	75,959	61,322	1,146	37,175	1,091,119
1931	713,880	713,313	7,236	73,361	36,825	128	3,012	826,511

Gypsum and gypsum products exported from the United States, 1927–1931 [1]

Year	Short tons	Value	Year	Short tons	Value
1927	18,429	$471,106	1930	23,611	$420,728
1928	18,788	416,748	1931	11,275	234,540
1929	28,809	512,186			

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[1] Exports classification for 1927 reads "Gypsum or plaster, crude, ground, calcined, and manufactures of." For 1928 to 1931 exports are recorded as follows: "Crude, crushed, or ground," 2,365 short tons, valued at $23,764, in 1928; 4,230 tons, $30,870, in 1929; 3,603 tons, $22,918, in 1930; and 4,502 tons, $37,816, in 1931; and "Plaster, calcined, and manufactures, n.e.s.," 16,423 tons, $392,984, in 1928; 24,579 tons, $481,316, in 1929; 20,008 tons, $397,810, in 1930; and 6,773 tons, $196,724, in 1931.

ILMENITE

[See Titanium minerals]

IRON ORE, PIG IRON, AND STEEL

IRON ORE

[Exclusive of all domestic ore containing 5 per cent or more of manganese. For data regarding such ore see Manganese]

Iron ore mined in the United States, 1927–1931, by varieties, in long tons

Year	Hematite	Brown ore	Magnetite	Carbonate	Total
1927	[1,2] 58,505,543	[1] 743,478	[2] 2,489,586	2,493	61,741,100
1928	[2] 59,207,857	816,637	[2] 2,170,804	1,790	62,197,088
1929	[1,2] 69,849,231	[1] 775,610	[2] 2,401,104	1,775	73,027,720
1930	[1,2] 55,265,954	[1] 720,496	[2] 2,421,211	1,003	58,408,664
1931	[2] 29,665,475	359,960	[2] 1,105,249	818	31,131,502

[1] Some hematite included with brown ore.

[2] Some hematite included with magnetite.

Iron ore mined in the United States in 1931, by mining districts and varieties, in long tons

District	Hematite	Brown ore	Magnetite	Carbonate	Total
Lake Superior [1]	25,877,385				25,877,385
Birmingham	3,369,481	125,442			3,494,923
Chattanooga		57,129			57,129
Adirondack			[2] 254,308		[2] 254,308
Northern New Jersey and southeastern New York			314,535		314,535
Other districts	[2] 418,609	177,389	536,406	818	[2] 1,133,222
	[2] 29,665,475	359,960	[2] 1,105,249	818	31,131,502

[1] Includes only those mines in Wisconsin which are in the true Lake Superior district.

[2] Some hematite from "Other districts" included with magnetite from Adirondack district.

Iron ore mined in the Lake Superior district, 1927–1931, by ranges, in long tons

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1927	4, 015, 730	5, 458, 182	6, 604, 830	1, 577, 817	32, 866, 034	1, 017, 287	51, 539, 880
1928	3, 755, 343	4, 855, 735	6, 342, 092	1, 628, 289	34, 856, 333	1, 079, 383	52, 517, 175
1929	4, 545, 839	5, 428, 469	7, 089, 602	1, 883, 547	42, 371, 192	1, 506, 119	62, 824, 768
1930	4, 419, 816	4, 431, 077	6, 014, 011	1, 996, 516	31, 299, 900	1, 221, 332	49, 382, 652
1931	2, 650, 996	2, 083, 157	3, 698, 229	1, 181, 224	15, 598, 767	665, 012	25, 877, 385

Iron ore shipped from mines in the United States, 1927-1931

[Exclusive of ore sold for paint. See p. A61]

Year	Long tons	Value
1927	61, 232, 473	$151, 125, 820
1928	63, 432, 826	155, 788, 657
1929	75, 602, 734	197, 148, 640
1930	55, 201, 221	$145, 619, 059
1931	28, 516, 032	74, 123, 910

Iron ore shipped from mines in the United States, 1930 and 1931, by States

[Exclusive of ore sold for paint. See p. A61]

State	1930		1931	
	Long tons	Value	Long tons	Value
Alabama	5, 637, 678	$11, 015, 336	3, 629, 997	$6, 155, 995
Arizona	923	(1)		
Colorado	32, 247	(1)	26, 202	(1)
Georgia	52, 221	147, 964	20, 745	51, 513
Michigan	11, 154, 773	31, 515, 996	5, 555, 376	15, 986, 273
Minnesota	34, 165, 777	90, 835, 451	17, 063, 591	46, 020, 269
Missouri	132, 749	508, 354	112, 055	337, 144
New Jersey	391, 528	1, 632, 827	239, 722	984, 021
New Mexico	173, 432	(1)	168, 075	(1)
New York	755, 074	3, 663, 155	259, 184	1, 067, 489
Pennsylvania	894, 039	1, 850, 661	436, 920	913, 163
Tennessee	27, 384	76, 089	8, 717	36, 156
Utah	278, 918	(1)	183, 668	(1)
Virginia	36, 178	65, 528		
Washington			1, 032	(1)
Wisconsin	1, 148, 277	3, 179, 175	629, 977	1, 658, 670
Wyoming	320, 023	(1)	180, 771	(1)
Undistributed		[2] 1, 128, 523		[2] 913, 217
	55, 201, 221	145, 619, 059	28, 516, 032	74, 123, 910

(1) Included under "Undistributed."

[2] This figure covers States entered as "(1)" above.

Stocks of iron ore at mines in the United States, December 31, 1927–1931, in long tons

1927	10, 104, 673
1928	9, 190, 061
1929	7, 067, 206
1930	10, 383, 152
1931	13, 063, 708

Stocks of iron ore at mines in the United States, December 31, 1930 and 1931, in long tons

State	1930	1931
Alabama	909, 498	894, 645
Iowa	12, 165	12, 165
Michigan	6, 654, 663	8, 669, 145
Minnesota	2, 171, 194	2, 600, 852
Missouri		317
New Jersey	65, 163	119, 109
New York	160, 430	178, 899
North Carolina	200	200
Pennsylvania	103, 183	33, 254
Virginia	3. 473	3, 473
Wisconsin	303, 183	551, 649
	10, 383, 152	13, 063, 708

Iron ore imported into and exported from the United States, 1927–1931

Year	Imports		Exports	
	Long tons	Value	Long tons	Value
1927	2, 620, 717	$6, 068, 283	898, 793	$3, 425, 435
1928	2, 452, 646	5, 428, 019	1, 282, 306	4, 797, 881
1929	3, 139, 334	8, 145, 354	1, 304, 417	4, 774, 842
1930	2, 775, 124	8, 113, 039	752, 267	2, 734, 168
1931	1, 465, 613	3, 901, 775	435, 665	1, 657, 832

PIG IRON

Pig iron shipped from blast furnaces in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	34, 866, 644	$646, 226, 139	1930	29, 905, 355	$512, 165, 131
1928	38, 303, 699	661, 351, 270	1931	17, 812, 579	285, 147, 156
1929	41, 549, 161	731, 858, 075			

Pig iron shipped from blast furnaces in the United States, 1930 and 1931, by States

State	1930		1931	
	Long tons	Value	Long tons	Value
Alabama	2, 294, 513	$31, 083, 905	1, 617, 331	$20, 024, 541
Colorado	(1)	(1)	(1)	(1)
Illinois	3, 050, 743	54, 290, 144	1, 727, 834	29, 178, 510
Indiana	3, 195, 517	52, 869, 137	1, 721, 925	28, 458, 099
Iowa	------	------	(1)	(1)
Kentucky	85, 328	(1)	128, 194	(1)
Maryland	981, 466	(1)	677, 076	(1)
Massachusetts	(1)	(1)	(1)	(1)
Michigan	711, 224	12, 859, 820	519, 643	8, 964, 439
Minnesota	266, 622	(1)	17, 878	(1)
New Jersey	405	(1)	------	------
New York	1, 638, 323	29, 160, 894	1, 014, 320	15, 568, 275
Ohio	6, 541, 212	111, 529, 209	4, 290, 669	69, 001, 692
Pennsylvania	9, 734, 591	176, 521, 843	5, 099, 016	86, 877, 965
Tennessee	42, 197	828, 716	13, 094	293, 111
Utah	(1)	(1)	(1)	(1)
Virginia	50, 629	(1)	26, 519	(1)
West Virginia	704, 654	(1)	593, 831	(1)
Undistributed	[2] 607, 931	[2] 43, 021, 463	[2] 365, 249	[2] 26, 780, 524
	29, 905, 355	512, 165, 131	17, 812, 579	285, 147, 156

[1] Included under "Undistributed."
[2] This figure covers States entered as "(1)" above.

Pig iron imported into and exported from the United States, 1927–1931

Year	Imports		Exports	
	Long tons	Value	Long tons	Value
1927	132, 568	$2, 254, 355	50, 992	$1, 028, 425
1928	140, 694	2, 232, 094	84, 682	1, 366, 794
1929	147, 763	2, 398, 488	46, 357	830, 225
1930	137, 031	1, 806, 754	13, 671	291, 683
1931	84, 411	978, 683	6, 719	150, 658

STEEL

Steel produced in the United States, 1927–1931, in long tons [1]

Year	Bessemer	Open hearth	Crucible	Other steel	Total
1927	6, 191, 727	38, 068, 335	9, 036	666, 087	44, 935, 185
1928	6, 620, 195	44, 113, 956	7, 769	802, 260	51, 544, 180
1929	7, 122, 509	48, 352, 888	6, 645	951, 431	56, 433, 473
1930	5, 035, 459	35, 049, 172	2, 253	612, 599	40, 699, 483
1931	3, 023, 446	22, 509, 566	1, 547	410, 942	25, 945, 501

[1] According to the American Iron and Steel Institute.

LEAD [1]

Refined primary lead produced in the United States from domestic ores, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	668, 320	$84, 208, 000	1930	573, 740	$57, 374, 000
1928	626, 202	72, 639, 000	1931	390, 260	28, 879, 000
1929	672, 498	84, 735, 000			

[1] For prices of lead, see statement on p. A16.

Refined primary lead produced in the United States, 1927–1931, in short tons

	1927	1928	1929	1930	1931
Domestic ore:					
Desilverized lead	378, 889	351, 734	381, 487	326, 801	211, 415
Soft lead	233, 944	225, 003	235, 345	201, 361	138, 389
Desilverized soft lead	55, 487	49, 465	55, 666	45, 578	40, 456
Total from domestic ore	668, 320	626, 202	672, 498	573, 740	390, 260
Foreign ore:					
Africa	12	----------	----------	----------	----------
Canada	4, 138	10, 123	9, 499	14, 369	3, 816
Central America	18	3	----------	----------	----------
Mexico	22, 674	14, 839	16, 807	14, 949	6, 420
South America	5, 506	1, 568	3, 285	3, 476	2, 299
Other foreign	21	99	84	1, 554	9, 719
Foreign base bullion:					
Mexico	95, 841	117, 193	51, 295	18, 592	30, 072
Peru	----------	11, 044	21, 165	16, 353	178
Total from foreign ore and base bullion	128, 210	154, 869	102, 135	69, 293	52, 504
Grand total from all sources	796, 530	781, 071	774, 633	643, 033	442, 764

Antimonial lead produced at primary refineries in the United States from both domestic and foreign primary and secondary sources, 1927–1931, in short tons

Year	Short tons	Year	Short tons
1927	33, 939	1930	24, 797
1928	45, 476	1931	21, 842
1929	43, 244		

Secondary lead recovered in the United States, 1927–1931

Year	Pig lead (short tons)	Lead in alloys (short tons)	Total	
			Short tons	Value
1927	119,000	157,000	276,000	$34,776,000
1928	138,000	170,600	308,600	35,797,600
1929	138,500	172,500	311,000	39,186,000
1930	129,000	126,800	255,800	25,580,000
1931	128,800	105,900	234,700	17,367,800

Lead imported for consumption in the United States, 1927–1931, by classes

Year	Lead in ore and matte [1]		Lead in base bullion		Pigs, bars, and old		Sheets, pipe, and shot		Not otherwise specified (value)	Total value
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value		
1927	70,260,478	$4,203,897	14,629,606	$925,328	9,933,679	$635,807	988,170	$104,890	$52,626	$5,922,548
1928	46,511,508	2,626,231	13,397,455	560,983	20,488,373	808,359	775,329	67,131	134,995	4,197,699
1929	21,645,699	1,160,533	12,395,696	627,455	20,178,922	1,052,087	899,595	78,776	126,966	3,045,817
1930	30,915,964	1,461,350	20,846,713	1,127,920	1,141,442	60,493	908,809	78,737	87,612	2,816,112
1931	21,467,418	1,194,191	20,871,628	671,002	[2] 19,863	[2] 1,763	855,341	60,536	49,990	1,977,482

[1] Classification as follows: 1927 to June 17, 1930, "Lead in ore and matte"; June 18, 1930, to Dec. 31, 1931, "Lead in ores, flue dust, and mattes, n. s. p. f."

[2] Reclaimed scrap, etc. No imports of pigs, bars, etc., recorded for 1931.

Miscellaneous products containing lead imported for consumption in the United States, 1927–1931

Year	Babbitt metal, solder, white metal, and other combinations, containing lead			Type metal and antimonial lead		
	Gross weight (pounds)	Lead content (pounds)	Value	Gross weight (pounds)	Lead content (pounds)	Value
1927	2,527,186	1,237,277	$932,055	878,346	666,654	$65,049
1928	1,876,432	845,199	569,486	3,990,548	3,086,770	193,177
1929	3,010,465	1,326,102	777,354	5,440,857	4,849,979	180,679
1930	2,797,463	1,060,556	593,103	656,841	550,444	32,934
1931	1,812,653	619,861	436,574	------------	------------	------------

Lead imported into the United States, in ore, base bullion, and refined, 1927–1931, by sources, in pounds

[General imports]

Year	Canada	Mexico	South America	Europe	Other countries	Total
1927	6,214,867	300,634,815	14,583,513	1,226,049	118,883	322,778,127
1928	14,352,967	275,184,287	20,408,574	56,406	85,915	310,088,149
1929	9,023,527	175,872,302	47,052,018	29,441	141,480	232,118,768
1930	34,536,897	73,442,591	44,943,694	226,294	3,283,888	156,433,364
1931	5,236,264	77,410,574	4,342,077	------------	19,446,230	106,435,145

Lead imported into the United States, 1927–1931, by classes, in pounds

[General imports]

Year	Lead in ore	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1927	81, 276, 126	236, 567, 252	4, 934, 749	322, 778, 127
1928	51, 829, 530	256, 935, 461	1, 323, 158	310, 088, 149
1929	62, 661, 371	166, 141, 916	3, 315, 481	232, 118, 768
1930	78, 753, 878	77, 260, 580	418, 906	156, 433, 364
1931	41, 775, 674	64, 639, 608	[1] 19, 863	106, 435, 145

[1] Reclaimed scrap, etc. No imports of pigs, bars, etc., recorded for 1931.

Lead exported from the United States, 1927–1931, by classes

Year	Pigs and bars				Foreign lead used in articles exported with benefit of drawback [1]	Manufactures of lead from both domestic and foreign ores
	From domestic ore		From foreign ore			
	Pounds	Value	Pounds	Value	Pounds	
1927	5, 066, 035	$308, 698	245, 467, 875	$12, 508, 566	24, 008, 803	$1, 318, 134
1928	28, 403, 279	1, 299, 021	204, 134, 083	9, 060, 200	26, 448, 902	1, 645, 909
1929	38, 515, 061	1, 918, 081	107, 985, 100	5, 260, 256	26, 171, 983	1, 634, 865
1930	8, 081, 117	374, 987	88, 532, 010	3, 529, 226	24, 322, 447	636, 021
1931	[2] 43, 330, 637	[2] 1, 241, 881	(2)	(2)	21, 005, 744	242, 582

[1] Exclusive of lead that entered as pig and was exported in the same form which would be duplicated in exports of lead from foreign ore.

[2] Foreign included with domestic; not separately recorded for 1931.

LIME

Lime sold by producers in the United States, 1927–1931

Year	Hydrated			Total		
	Number of plants in operation	Short tons	Value [1]	Number of plants in operation	Short tons	Value [1]
1927	157	1, 596, 906	$14, 581, 695	417	4, 414, 932	$38, 638, 413
1928	164	1, 612, 818	13, 540, 215	411	4, 458, 412	36, 449, 635
1929	157	1, 550, 771	12, 771, 525	381	4, 269, 768	33, 478, 848
1930	163	1, 329, 562	10, 357, 445	375	3, 387, 880	25, 616, 486
1931	157	1, 119, 266	7, 729, 047	345	2, 707, 614	18, 674, 913

[1] The value given represents the value of bulk lime f. o. b. at point of shipment and does not include cost of barrel or package.

Lime sold by producers in the United States, 1930 and 1931, by States

State	1930			1931		
	Number of plants in operation	Short tons	Value	Number of plants in operation	Short tons	Value
Alabama	8	164,822	$929,302	8	137,423	$823,437
Arizona	5	35,642	317,881	4	22,567	222,785
Arkansas	4	30,349	241,938	2	22,520	153,733
California	9	51,302	498,795	9	41,371	389,696
Colorado	4	6,777	73,156	4	4,646	50,823
Connecticut	4	28,489	282,521	1	(1)	(1)
Florida	2	(1)	(1)	2	(1)	(1)
Georgia	1	7,455	50,655	1	5,139	34,339
Hawaii	1	7,591	92,043	1	7,332	89,911
Idaho	3	2,463	25,156	3	880	8,580
Illinois	9	89,709	721,143	9	96,105	718,952
Indiana	9	87,965	600,784	8	81,925	502,232
Iowa	----------	----------	----------	1	(1)	(1)
Kentucky	2	(1)	(1)	1	(1)	(1)
Maine	3	66,775	542,115	3	28,157	250,028
Maryland	11	53,090	398,841	11	36,445	268,148
Massachusetts	7	107,502	1,072,008	6	123,607	1,108,036
Michigan	5	80,241	630,288	5	46,716	334,015
Minnesota	3	(1)	(1)	3	(1)	(1)
Missouri	14	265,771	1,861,105	12	224,416	1,481,240
Montana	2	(1)	(1)	1	2,028	26,666
Nevada	1	(1)	(1)	1	(1)	(1)
New Jersey	1	(1)	(1)	1	(1)	(1)
New Mexico	4	2,369	21,446	2	(1)	(1)
New York	10	83,078	702,475	9	49,574	412,351
North Carolina	1	(1)	(1)	1	(1)	(1)
Ohio	23	736,305	5,711,855	24	656,441	4,007,004
Oklahoma	1	(1)	(1)	----------	----------	----------
Oregon	3	1,741	25,196	2	(1)	(1)
Pennsylvania	115	633,520	4,661,670	105	497,258	3,378,088
Puerto Rico	12	9,764	130,680	12	11,302	138,122
Rhode Island	1	2,638	34,986	1	2,042	24,846
South Dakota	1	(1)	(1)	1	2,682	29,000
Tennessee	10	147,648	855,452	10	113,268	566,694
Texas	6	74,081	639,821	6	45,553	384,392
Utah	11	27,522	236,607	7	18,192	172,534
Vermont	8	45,963	406,921	7	30,226	271,417
Virginia	26	146,996	960,219	26	100,659	654,665
Washington	5	26,913	266,131	5	20,619	215,033
West Virginia	13	228,230	1,394,075	15	170,420	985,687
Wisconsin	16	64,989	598,739	15	42,621	372,244
Wyoming	1	(1)	(1)	----------	----------	----------
Undistributed	----------	70,180	632,482	----------	65,480	600,215
	375	3,387,880	25,616,486	345	2,707,614	18,674,913

[1] Included under "Undistributed."

Lime imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1927	19,567	$356,836	15,478	$210,977
1928	18,321	344,296	18,188	245,004
1929	21,501	390,736	17,334	239,440
1930	[1] 20,706	[1] 278,897	14,536	192,421
1931	[1] 14,458	[1] 181,867	11,924	129,943

[1] Also 3,024 short tons of dead-burned dolomite, valued at $77,918, imported June 18 to Dec. 31, 1930; not separately recorded prior to change in tariff. Similar additional imports in 1931 recorded as 6,051 tons, $152,795.

LITHIUM MINERALS

Lithium minerals produced in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	4,173	$59,656	1930	1,797	$56,327
1928	4,600	94,750	1931	(1)	(1)
1929	(1)	(1)			

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[1] Bureau of Mines not at liberty to publish figures.

Imports and exports of lithium minerals are not separately recorded.

LITHOGRAPHIC STONE

No domestic production of lithographic stone in the United States has been reported since 1918.

Lithographic stone imported for consumption in the United States, 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	45,398	$6,790	1930	57,186	$8,706
1928	63,505	9,963	1931	5,989	562
1929	74,841	7,788			

No exports of lithographic stone are reported.

MAGNESITE

Crude magnesite mined in the United States, 1927–1931

Year	California		Washington		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	43,750	$507,500	77,740	$583,050	121,490	$1,090,550
1928	41,300	454,300	85,900	644,250	127,200	1,098,550
1929	[1] 187,660	[1] 1,500,000	(1)	(1)	187,660	1,500,000
1930	[1] 129,320	[1] 1,033,130	(1)	(1)	129,320	1,033,130
1931	[1] 73,602	[1] 499,239	(1)	(1)	73,602	499,239

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[1] Washington included with California. Bureau of Mines not at liberty to publish figures.

Magnesite imported for consumption in the United States, 1927–1931

Year	Crude		Calcined	
	Short tons	Value	Short tons	Value
1927	856	$8,574	59,261	$946,361
1928	762	6,264	62,481	966,183
1929	300	3,179	56,879	877,090
1930	842	8,687	45,328	691,236
1931	499	5,415	13,240	243,375

Exports are not separately recorded.

MAGNESIUM

New ingot magnesium [1] *produced and sold in the United States, 1928–1931*

Year	Produced (pounds)	Sold or used by producer	
		Pounds	Value
1928	521,075	530,782	$289,658
1929	1,329,669	908,351	512,313
1930	1,173,557	559,631	268,864
1931	(2)	580,463	199,633

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[1] Figures for new ingot magnesium for 1927 not available. Domestic metallic magnesium (ingots, castings, alloys, ribbon, powder, rods, tubes, sheets, etc.) sold or used by producers in the United States in 1927 amounted to 366,400 pounds, valued at $441,700.

[2] Figures not available.

Magnesium imported for consumption in the United States, 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	7,131	$8,402	1930	5,689	$19,599
1928	12,039	11,890	1931	2,454	2,580
1929	3,490	6,539			

Exports are not separately recorded.

MANGANESE

Manganese and manganiferous ore (exclusive of fluxing ore) shipped from mines in the United States, 1927–1931

Year	Ore containing 35 per cent of manganese or more			Ore containing 10 to 35 per cent of manganese			Ore containing 5 to 10 per cent of manganese		
	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value
1927	39	44,741	$1,151,918	47	148,291	$673,921	9	1,310,127	$3,270,460
1928	38	46,860	1,214,853	31	90,581	407,289	8	1,085,401	2,645,165
1929	36	60,379	1,612,357	32	78,191	451,843	8	1,110,067	2,822,623
1930	27	67,035	1,437,465	27	77,417	566,155	6	707,973	1,835,450
1931	24	39,242	699,121	14	64,062	405,749	4	217,352	570,800

No manganese ore (35 per cent of manganese or more) has been shipped for fluxing purposes since 1924. During the 5-year period, 1927 to 1931, shipments of manganiferous ore for fluxing have been as follows: 1927, 1,029 long tons of ferruginous manganese ore (10 to 35 per cent of manganese) and 2,161 long tons of manganiferous iron ore (5 to 10 per cent of manganese), with a combined value of $2,635; 1928, 48 and 1,602 tons, respectively, with a combined value of $853. No manganiferous ore has been shipped for fluxing purposes since 1928.

Manganese and manganiferous ore (exclusive of fluxing ore) shipped from mines in the United States in 1931, by States

State	Ore containing 35 per cent of manganese or more			Ore containing 10 to 35 per cent of manganese			Ore containing 5 to 10 per cent of manganese		
	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value
Metallurgical:									
Alabama				3	1,321	$5,848			
Arkansas	4	4,028	$80,915	1	2,230	(1)			
California	1	40	(1)						
Colorado				1	3,685	21,880			
Georgia	3	6,491	(1)	2	11,652	(1)			
Idaho				1	578	(1)			
Michigan				1	2,217	(1)			
Minnesota				1	26,567	162,988	4	217,352	$570,800
Montana	[2] 2	17,088	(1)	1	14,311	(1)			
New Mexico	1	1,072	(1)						
Tennessee	1	70	(1)						
Texas	2	155	(1)						
Utah				3	1,501	16,601			
Virginia	[2] 4	901	16,650						
West Virginia	1	29	(1)						
Undistributed			297,834			198,432			
Total metallurgical	19	29,874	395,399	14	64,062	405,749	4	217,352	570,800
Battery:									
Montana	[2,3] 2	7,802	281,523						
Virginia	[2] 1	150							
Total battery	3	7,952	281,523						
Miscellaneous:									
Arizona	1	40	600						
Montana	[2] 3	922	14,342						
Virginia	[2] 3	454	7,257						
Total miscellaneous	7	1,416	22,199						
Grand total	24	39,242	699,121	14	64,062	405,749	4	217,352	570,800

[1] Included under "Undistributed."

[2] 1 producer in Montana and 1 in Virginia shipped both metallurgical and miscellaneous ore; 2 producers in Montana shipped both battery and miscellaneous ore; and 1 producer in Virginia shipped both metallurgical and battery ore.

[3] Mills through which all ore was shipped; producers not counted.

Manganiferous iron ore shipped from the Cuyuna district, Minnesota, 1927–1931, in long tons

Year	Ore containing 10 to 35 per cent of manganese	Ore containing 5 to 10 per cent of manganese	Year	Ore containing 10 to 35 per cent of manganese	Ore containing 5 to 10 per cent of manganese
1927	6,276	934,599	1930	4,698	693,546
1928	3,487	1,025,014	1931	26,567	217,352
1929	5,421	1,004,420			

Manganese ore imported for consumption in the United States, 1927–1931

Year	Long tons		Value	Year	Long tons		Value
	Gross weight	Manganese content			Gross weight	Manganese content	
1927	620,212	304,388	$9,271,920	1930	454,625	216,871	$5,267,415
1928	565,938	269,712	6,827,621	1931	293,137	141,534	3,122,835
1929	660,558	318,310	8,182,874				

No separate record of exports of manganese ore is kept.

MANGANIFEROUS ZINC RESIDUUM

Manganiferous residuum, from zinc roasting in the United States, shipped in 1927–1931, in long tons

Year	Long tons
1927	184, 771
1928	171, 107
1929	168, 363
1930	113, 060
1931	96, 990

MARLS

Calcareous marl sold by producers in the United States, 1927–1931

Year	Short tons	Value
1927	52, 962	$180, 166
1928	61, 034	200, 704
1929	38, 990	130, 866
1930	34, 012	$112, 523
1931	25, 056	65, 935

Greensand marl produced in the United States, 1927–1931

Year	Short tons	Value
1927	11, 911	$168, 683
1928	12, 988	207, 042
1929	13, 266	255, 680
1930	12, 761	$221, 211
1931	8, 252	196, 327

No imports or exports of marl are reported.

MERCURY

Mercury produced in the United States, 1927–1931

[Flasks of 76 pounds]

Year	Flasks	Value
1927	11, 128	$1, 314, 782
1928	17, 870	2, 207, 003
1929	23, 682	2, 892, 638
1930	21, 553	$2, 478, 789
1931	24, 947	2, 179, 145

Mercury imported into and exported from the United States, 1927–1931

[Flasks of 76 pounds]

Year	Imports for consumption		Exports	
	Flasks	Value	Flasks	Value
1927	19, 941	$1, 780, 134	(1)	(1)
1928	14, 562	1, 437, 153	(1)	(1)
1929	14, 917	1, 513, 197	(1)	(1)
1930	3, 725	361, 810	(1)	(1)
1931	549	48, 540	[2] 4, 984	[2] $433, 596

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[1] Exports of mercury not separately recorded from 1927 to 1930.

[2] From a special compilation made by the Section of Customs Statistics, Bureau of Foreign and Domestic Commerce, at the request of the Bureau of Mines.

MICA

Mica sold or used by producers in the United States, 1927–1931

Year	Uncut sheet mica		Scrap mica		Total	
	Pounds	Value	Short tons	Value	Short tons	Value
1927	1, 512, 492	$212, 482	6, 280	$110, 139	7, 036	$322, 621
1928	1, 681, 777	230, 956	7, 760	132, 422	8, 601	363, 378
1929	2, 035, 128	286, 321	6, 253	117, 901	7, 271	404, 222
1930	1, 465, 485	177, 307	6, 732	109, 100	7, 465	286, 407
1931	962, 953	111, 830	6, 621	99, 415	7, 102	211, 245

Mica imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Pounds	Value	Pounds	Value
1927	3, 459, 647	$1, 630, 309	2, 867, 798	$207, 263
1928	4, 104, 975	1, 426, 495	3, 661, 587	229, 391
1929	6, 475, 665	2, 223, 408	6, 187, 270	329, 322
1930	6, 958, 145	1, 283, 616	4, 732, 864	262, 826
1931	6, 098, 419	620, 784	5, 239, 007	258, 135

MILLSTONES

[See Abrasive materials]

MINERAL PAINTS

Domestic zinc and lead pigments,[1] *made in large part direct from ores in the United States, sold by producers, 1927–1931*

Year	Short tons	Value
1927	191, 853	$25, 275, 975
1928	202, 363	26, 017, 743
1929	204, 574	26, 211, 556
1930	147, 948	$18, 420, 436
1931	123, 963	15, 225, 300

[1] Include sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide.

The canvass of natural mineral pigments was discontinued after 1915. Figures covering iron ore sold for paint, 1927 to 1931, follow.

Iron ore sold for paint, by producers, in the United States, 1927–1931

Year	Short tons	Value
1927	25, 023	$132, 007
1928	17, 815	83, 190
1929	15, 754	90, 352
1930	10, 832	$53, 520
1931	6, 176	29, 759

MINERAL WATERS

No figures of sales of natural mineral waters by producers in the United States are available. Canvass was discontinued after 1923.

Mineral waters (natural and artificial) imported for consumption in the United States, 1927–1931

Year	Gallons	Value	Year	Gallons	Value
1927	1,000,038	$500,757	1930	919,989	$477,158
1928	804,502	396,006	1931	963,314	490,455
1929	1,031,835	510,911			

Mineral waters (natural and artificial) exported from the United States, 1927–1931

Year	Gallons	Value	Year	Gallons	Value
1927	197,978	$173,145	1930	162,435	$155,994
1928	195,191	184,231	1931	108,024	94,663
1929	196,275	188,793			

MOLYBDENUM

Molybdenum in ore and concentrates, produced in the United States, sold in 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	2,286,075	$1,858,786	1930	3,759,269	[1] $2,068,000
1928	3,329,214	1,924,600	1931	3,157,000	[1] 1,577,000
1929	3,904,648	[1] 2,259,000			

[1] Estimate by Bureau of Mines.

"Molybdenum ore (steel-hardening)" imported into the United States in 1927 contained 12,541 pounds of molybdenum and was valued at $10,472; no imports have been reported since 1927. For imports of ferromolybdenum see Ferro-alloys.

Exports of ferromolybdenum are not separately classified.

MONAZITE

[See Thorium minerals]

NICKEL

Nickel content of nickel salts and metallic nickel produced in the United States as a by-product in the electrolytic refining of copper, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	860	$390,740	1930	308	$213,803
1928	522	291,836	1931	373	202,406
1929	340	297,273			

Secondary nickel recovered as metal and in nonferrous alloys and salts in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	3,380	$2,366,000	1930	2,900	$2,030,000
1928	4,500	3,150,000	1931	2,070	1,449,000
1929	4,350	3,045,000			

Value of nickel imported for consumption in the United States, 1927–1931

Year	Nickel, nickel ore and matte, nickel oxide, and alloys of nickel with copper, etc.	Manufactures and nickel sheets and strips	Total
1927	$8,802,075	$111,816	$8,913,891
1928	14,069,357	294,839	14,364,196
1929	19,098,105	318,154	19,416,259
1930	12,750,721	128,106	12,878,827
1931	7,565,824	48,010	7,613,834

Nickel imported for consumption in the United States, 1930 and 1931, by classes

Class	1930		1931	
	Pounds	Value	Pounds	Value
Unmanufactured:				
Nickel ore and matte	20,593,361	$2,940,074	11,629,709	$1,530,557
Nickel alloys, pigs, bars, etc	38,323,029	9,600,404	23,633,754	5,987,610
Nickel oxide	1,353,096	209,420	304,991	47,522
Nickel silver or German silver	6,456	823	100	135
Manufactured:				
Nickel silver or German silver in sheets, strips, and rods	10,101	6,513	10,111	5,247
All other manufactures of nickel		121,593		42,763
		12,878,827		7,613,834

Nickel exported from the United States, 1929–1931, by classes

Class	1929		1930		1931	
	Pounds	Value	Pounds	Value	Pounds	Value
Nickel Monel metal and other alloys	2,869,686	$1,115,568	2,839,446	$1,207,612	1,776,917	$648,026
Manufactures	(1)	1,347,391	(1)	923,547	(1)	438,333
Nickel-chrome electric resistance wire	(2)	(2)	(2)	(2)	175,707	253,107
Nickel silver or German silver in bars, rods, or sheets	1,044,181	325,992	1,122,050	243,528	409,847	72,350
Nickel salts	42,195	6,400	815,512	55,277	(3)	(3)

[1] Quantity not recorded.

[2] Not separately recorded prior to 1931.

[3] Not separately recorded.

OILSTONES AND SCYTHESTONES

[See Abrasive materials]

ORE

Crude metallic ores (including old tailings, etc.) shipped from or treated at the mine in the United States, 1927–1931, in short tons

[Figures rounded]

Class of ore	1927	1928	1929	1930	1931
Aluminum ore (bauxite)	359,000	420,000	410,000	370,000	219,000
Chromite	220	740	300	90	300
Dry and siliceous (gold and silver) ore	8,550,000	8,095,000	7,671,000	7,767,000	8,329,000
Iron ore [1]	68,561,000	71,036,000	84,675,000	61,825,000	31,938,000
Manganese ore (35 per cent or more Mn)[1]	50,000	52,000	68,000	75,000	44,000
Manganiferous ore (5 to 35 per cent Mn)[1]	1,633,000	1,317,000	1,331,000	880,000	315,000
Mercury ore	(2)	(2)	(2)	(2)	(2)
Copper ore:					
Western States	48,106,000	53,930,000	59,894,000	39,807,000	29,903,000
Central States	8,046,000	7,362,000	7,598,000	6,659,000	3,571,000
Eastern States	674,000	833,000	930,000	916,000	575,000
	56,826,000	62,125,000	68,422,000	47,382,000	34,049,000
Copper-lead and copper-lead-zinc ore	419,000	351,000	259,000	246,000	213,000
Lead ore:					
Western States	2,005,000	1,687,000	1,592,000	1,380,000	894,000
Central States	6,344,000	6,361,000	6,573,000	6,700,000	5,149,000
	8,349,000	8,048,000	8,165,000	8,080,000	6,043,000
Lead-zinc ore:					
Western States	3,135,000	3,583,000	3,497,000	2,605,000	1,484,000
Central States	11,310,000	9,796,000	10,972,000	7,327,000	3,259,000
Eastern States	202,000			713,000	684,000
	14,647,000	13,379,000	14,469,000	10,645,000	5,427,000
Zinc ore:					
Western States	452,000	161,000	494,000	249,000	98,000
Central States	5,177,000	4,350,000	5,076,000	4,200,000	2,894,000
Eastern States	1,194,000	1,344,000	1,623,000	1,531,000	1,508,000
	6,823,000	5,855,000	7,193,000	5,980,000	4,500,000
Grand total	166,217,000	170,679,000	192,663,000	143,250,000	91,077,000

[1] Exclusive of fluxing ore.

[2] Figures not available.

PEAT

No figures of domestic output of peat are available. Canvass was discontinued after 1926.

Peat moss imported for consumption in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	31,595	$326,549	1930	70,466	$869,381
1928	40,087	422,275	1931	63,928	682,553
1929	57,531	657,145			

PETROLEUM AND PETROLEUM PRODUCTS

CRUDE PETROLEUM

Crude petroleum produced in the United States, 1927–1931

[Barrels of 42 U. S. gallons]

Year	Barrels	Value at wells	Year	Barrels	Value at wells
1927	901, 129, 000	$1, 172, 830, 000	1930	898, 011, 000	$1, 070, 200, 000
1928	901, 474, 000	1, 054, 880, 000	1931	851, 081, 000	550, 630, 000
1929	1, 007, 323, 000	1, 280, 417, 000			

Crude petroleum produced in the United States, 1930 and 1931, by fields and States

	1930		1931	
	Barrels	Value at wells	Barrels	Value at wells
FIELD				
Appalachian	34, 105, 000	$76, 206, 000	30, 401, 000	$47, 320, 000
Lima-Indiana	1, 365, 000	2, 010, 000	1, 152, 000	1, 030, 000
Illinois and southwestern Indiana	6, 677, 000	10, 640, 000	5, 842, 000	5, 230, 000
Michigan	3, 911, 000	5, 160, 000	3, 789, 000	2, 840, 000
Mid-Continent	531, 447, 000	601, 470, 000	543, 736, 000	305, 120, 000
Gulf coast	69, 676, 000	72, 850, 000	57, 592, 000	37, 990, 000
Rocky Mountain [1]	23, 501, 000	30, 165, 000	19, 739, 000	15, 140, 000
California	227, 329, 000	271, 699, 000	188, 830, 000	135, 960, 000
Other fields [2]	(1)	(1)	(1)	(1)
	898, 011, 000	1, 070, 200, 000	851, 081, 000	550, 630, 000
STATE				
Alaska	[3] 7, 000	[3] 15, 000	[3] 7, 000	[3] 15, 000
Arkansas	19, 702, 000	17, 390, 000	14, 791, 000	7, 200, 000
California	227, 329, 000	271, 699, 000	188, 830, 000	135, 960, 000
Colorado	1, 656, 000	1, 480, 000	1, 545, 000	825, 000
Illinois	5, 736, 000	9, 100, 000	5, 039, 000	4, 500, 000
Indiana	994, 000	1, 610, 000	840, 000	750, 000
Kansas	41, 638, 000	54, 880, 000	37, 018, 000	25, 500, 000
Kentucky	7, 389, 000	11, 080, 000	6, 456, 000	5, 295, 000
Louisiana	23, 272, 000	26, 110, 000	21, 804, 000	14, 220, 000
Michigan	3, 911, 000	5, 160, 000	3, 789, 000	2, 840, 000
Montana	3, 349, 000	5, 420, 000	2, 830, 000	2, 730, 000
New Mexico	10, 189, 000	9, 180, 000	15, 227, 000	6, 490, 000
New York	3, 647, 000	9, 850, 000	3, 363, 000	6, 800, 000
Ohio	6, 486, 000	11, 960, 000	5, 327, 000	5, 610, 000
Oklahoma	216, 486, 000	279, 250, 000	180, 574, 000	119, 200, 000
Pennsylvania	12, 803, 000	33, 410, 000	11, 892, 000	23, 550, 000
Tennessee	21, 000	26, 000	6, 000	5, 000
Texas	290, 457, 000	288, 410, 000	332, 437, 000	170, 950, 000
Utah	(3)	(3)	(3)	(3)
West Virginia	5, 071, 000	11, 820, 000	4, 472, 000	7, 070, 000
Wyoming	17, 868, 000	22, 350, 000	14, 834, 000	11, 120, 000
	898, 011, 000	1, 070, 200, 000	851, 081, 000	550, 630, 000

[1] Production of Alaska included with Rocky Mountain.
[2] Alaska.
[3] Utah included with Alaska.

Crude petroleum imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports			
			Domestic petroleum		Foreign petroleum [1]	
	Barrels	Value	Barrels	Value	Barrels	Value
1927	58, 382, 632	$78, 609, 117	15, 843, 405	$25, 944, 489	241	$333
1928	79, 766, 672	90, 472, 376	18, 961, 362	26, 786, 248	995	1, 618
1929	78, 932, 572	79, 943, 429	26, 394, 349	37, 799, 683	9	23
1930	62, 129, 419	64, 872, 121	23, 704, 162	32, 153, 377	----------	----------
1931	47, 249, 655	39, 220, 620	25, 539, 159	20, 827, 852	----------	----------

[1] Exports of refined products and shipments of crude petroleum to Alaska, Hawaii, Puerto Rico, and the Philippine Islands are not included.

PETROLEUM PRODUCTS

Crude petroleum run to stills and chief petroleum products produced at refineries in the United States, 1927–1931, in barrels

Year	Crude petroleum run to stills		Chief petroleum products			
	Domestic	Foreign	Gasoline	Kerosene	Gas oil and fuel oil	Lubricants
1927	778,729,000	50,106,000	330,435,000	56,113,000	393,066,000	31,721,000
1928	835,711,000	77,584,000	376,945,000	59,353,000	427,237,000	34,658,000
1929	912,191,000	75,517,000	435,078,000	55,940,000	428,219,000	34,359,000
1930	866,615,000	60,832,000	432,241,000	49,208,000	372,498,000	34,201,000
1931	847,671,000	46,937,000	431,510,000	42,446,000	336,967,000	26,704,000

Chief petroleum products imported for consumption in the United States, 1927–1931, in barrels

Year	Gasoline	Kerosene	Gas oil and fuel oil	Lubricants
1927	5,002,306	55,435	8,124,192	7,944
1928	4,197,708	201,745	7,268,147	12,654
1929	8,835,502	208,008	20,545,498	39,355
1930	16,926,800	200,086	26,080,383	24,720
1931	13,621,355	11,477	24,998,016	31,600

Chief petroleum products exported from the United States, 1927–1931, in barrels

Year	Gasoline	Kerosene	Gas oil and fuel oil	Lubricants
1927	43,334,164	19,352,102	42,963,180	9,686,361
1928	51,751,754	21,846,633	41,573,185	10,933,160
1929	60,006,674	19,820,352	35,714,784	10,775,090
1930	63,195,331	16,689,684	32,377,758	9,849,297
1931	43,786,519	12,534,130	26,588,187	8,049,222

PHOSPHATE ROCK

Phosphate rock sold or used by producers in the United States, 1927–1931

Year	Long tons	Value
1927	3,170,699	$11,253,352
1928	3,501,406	12,443,179
1929	3,760,855	13,153,259
1930	3,926,392	$13,996,830
1931	2,534,959	9,288,485

Phosphate rock imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Long tons	Value	Long tons	Value
1927	28,195	$292,871	918,211	$4,731,562
1928	45,812	431,238	898,764	4,453,101
1929	44,899	469,171	1,142,746	5,386,919
1930	32,658	377,177	1,225,722	5,630,547
1931	13,496	162,517	951,305	4,277,070

PLATINUM AND ALLIED METALS

Reports received from refiners of crude platinum, gold bullion, and copper indicate that 36,205 troy ounces of refined new metals of the platinum group were recovered in 1931, of which 8,393 ounces are believed to be of domestic origin.

New platinum and allied metals recovered by refiners in the United States, 1927–1931, in troy ounces

Year	Platinum	Palladium	Iridium	Osmiridium	Others	Total
1927	41, 121	3, 879	256	631	163	46, 050
1928	51, 427	5, 148	1, 658	458	348	59, 039
1929	41, 760	5, 295	302	364	256	47, 977
1930	37, 780	3, 801	1, 468	334	119	43, 502
1931	31, 274	2, 742	1, 732	272	185	36, 205

Dealers and refiners reported recovery in 1931 of 43,734 ounces of secondary platinum metals derived from refining scrap metal, sweeps, and other waste products of manufacture that contain platinum.

Secondary platinum and allied metals recovered in the United States, 1927–1931, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1927	46, 127	4, 244	1, 810	891	53, 072
1928	47, 157	4, 156	2, 090	2, 428	55, 831
1929	33, 638	5, 120	2, 057	1, 944	42, 759
1930	33, 787	7, 426	4, 354	1, 749	47, 316
1931	33, 837	6, 331	1, 823	1, 743	43, 734

Platinum and allied metals imported for consumption in the United States, 1927–1931

Year	Troy ounces	Value
1927	148, 769	$12, 413, 494
1928	135, 233	9, 357, 737
1929	155, 075	9, 119, 479
1930	139, 246	$5, 836, 492
1931	129, 632	3, 531, 071

Platinum and allied metals imported for consumption in the United States, 1930 and 1931, by metals

Metal	1930		1931	
	Troy ounces	Value	Troy ounces	Value
Platinum:				
Ores of platinum metals (platinum content)	-------	-------	1, 097	$27, 466
Grains, nuggets, sponge, or scrap	81, 229	$3, 363, 858	67, 078	1, 905, 062
Ingots, bars, sheets or plates, not less than one-eighth inch thick	24, 926	961, 334	23, 553	657, 413
	106, 155	4, 325, 192	91, 728	2, 589, 941
Manufactures of, not jewelry	25	520	-------	-------
Iridium	4, 196	665, 475	1, 773	195, 961
Osmiridium	5, 654	319, 292	4, 877	225, 485
Osmium	1, 100	65, 642	960	49, 474
Palladium	18, 506	353, 772	28, 070	389, 880
Rhodium	2, 291	69, 717	1, 629	61, 402
Ruthenium	1, 319	36, 882	595	18, 928
	139, 246	5, 836, 492	129, 632	3, 531, 071

Platinum exported from the United States, 1927–1931

Year	Unmanufactured		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value
1927	19,923	$1,577,560	1,549	$128,875
1928	9,050	619,478	2,168	160,554
1929	2,567	193,122	1,455	112,252
1930	1,037	62,072	769	40,850
1931	1,209	40,769	1,190	48,464

POTASH

Crude potassium salts produced and sold in the United States, 1927–1931

Year	Produced			Sold		
	Number of plants	Gross weight (short tons)	Equivalent as K_2O (short tons)	Gross weight (short tons)	Equivalent as K_2O (short tons)	Value f. o. b. plant
1927	9	76,819	43,510	94,722	49,500	$2,448,146
1928	9	104,129	59,910	105,208	60,370	3,029,422
1929	5	107,820	61,590	101,370	57,540	2,988,448
1930	5	105,810	61,270	98,280	56,610	2,986,157
1931	6	133,920	63,880	133,430	63,770	3,086,955

Potash materials imported for consumption in the United States, 1927–1931

Year	Potassium salts used mainly in the fertilizer industry [1]			Potassium salts used mainly in chemical industries [2]			Total		
	Short tons		Value	Short tons		Value	Short tons		Value
	Gross weight	Equivalent as K_2O (approximate)		Gross weight	Equivalent as K_2O (approximate)		Gross weight	Equivalent as K_2O (approximate)	
1927	687,349	225,000	$13,178,610	43,248	19,155	$5,191,195	730,597	244,155	$18,369,805
1928	931,616	310,000	18,227,830	44,045	20,493	4,292,162	975,661	330,493	22,519,992
1929	870,502	297,000	17,629,535	58,968	27,638	6,043,106	929,470	324,638	23,672,641
1930	933,937	322,370	19,909,797	45,682	20,084	4,589,457	979,619	342,454	24,499,254
1931	528,764	194,100	12,225,733	48,431	20,685	4,274,749	577,195	214,785	16,500,482

[1] Includes kainite, manure salts, muriate, sulphate, and wood ashes. Considerable quantities of muriate and some sulphate were used in chemical industries.

[2] Includes bicarbonate, bichromate, bitartrate, bromide, carbonate, caustic, chlorate, chromate, citrate, cyanide, ferricyanide, ferrocyanide, iodide, nitrate, perchlorate, permanganate, and Rochelle salt.

Domestic potassium salts exported from the United States, 1927–1931

Year	Gross weight (short tons)	Value	Year	Gross weight (short tons)	Value
1927	1,965	$487,726	1930	1,256	$498,774
1928	2,619	609,018	1931	1,158	370,935
1929	1,523	583,668			

PUMICE

[See Abrasive materials]

PYRITES

Pyrites [1] produced in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	215, 786	$804, 006	1930	347, 512	$1, 028, 680
1928	312, 815	1, 081, 758	1931	330, 848	974, 820
1929	333, 465	1, 250, 141			

[1] Figures for 1928 to 1931 include by-product pyrites from zinc operations in Wisconsin and New York and pyrites and pyrrhotite concentrates from copper operations in Tennessee. Similar output for Wisconsin and Tennessee in 1927 not included in the statistics.

Pyrites containing more than 25 per cent of sulphur imported for consumption in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	250, 794	$647, 512	1930	354, 543	$1, 009, 081
1928	457, 123	1, 135, 463	1931	352, 066	1, 496, 197
1929	514, 336	1, 507, 648			

Exports are not separately recorded.

QUARTZ

[See Silica]

QUICKSILVER

[See Mercury]

RADIUM

[See Uranium and vanadium ores]

RUTILE

[See Titanium minerals]

SALT

Salt sold or used by producers in the United States, 1927–1931

Year	Short tons				Total value
	Manufactured (evaporated)	In brine	Rock salt	Total	
1927	2, 263, 030	3, 161, 800	2, 143, 860	7, 568, 690	$24, 817, 962
1928	2, 430, 050	3, 426, 870	2, 217, 780	8, 074, 700	26, 772, 568
1929	2, 546, 390	3, 884, 160	2, 113, 010	8, 543, 560	27, 334, 695
1930	2, 358, 610	3, 718, 460	1, 977, 370	8, 054, 440	25, 009, 480
1931	2, 203, 690	3, 300, 210	1, 854, 170	7, 358, 070	21, 541, 012

Salt sold or used by producers in the United States, 1930 and 1931, by States

State	1930		1931	
	Short tons	Value	Short tons	Value
California	350,370	$2,080,133	334,900	$2,000,567
Kansas	759,800	3,148,728	691,160	3,003,756
Louisiana	535,250	2,164,365	529,280	1,962,690
Michigan	2,558,290	7,884,072	2,053,980	5,760,001
New York	2,009,280	5,837,103	1,788,940	5,293,470
Ohio	1,311,440	3,015,206	1,398,000	2,526,952
Puerto Rico	(1)	(1)	11,560	19,878
Texas	(1)	(1)	103,040	468,562
Utah	85,240	188,983	74,010	159,778
West Virginia	28,670	184,327	35,480	218,762
Undistributed [2]	416,100	506,563	337,720	126,596
	8,054,440	25,009,480	7,358,070	21,541,012

[1] Included under "Undistributed."

[2] 1930: Nevada, New Mexico, Oklahoma, Puerto Rico, Texas, and Virginia; 1931: Nevada, New Mexico, Oklahoma, and Virginia.

Salt imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1927	44,968	$167,675	153,832	$1,329,980
1928	42,856	149,559	145,396	1,185,682
1929	36,450	131,716	109,222	1,008,842
1930	54,021	143,953	70,478	715,575
1931	33,216	84,511	98,710	775,490

SAND AND GRAVEL

Sand and gravel sold or used by producers in the United States, 1927–1931

Year	Glass sand		Molding sand		Building sand	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	2,171,693	$3,257,790	4,194,975	$4,458,508	40,737,377	$22,198,767
1928	2,310,828	3,435,645	4,781,765	5,089,969	45,629,207	24,116,772
1929	2,219,677	3,788,471	6,195,343	6,410,343	41,161,013	23,309,238
1930	1,849,101	3,210,973	3,336,855	3,547,154	33,599,524	18,850,936
1931	1,677,882	2,779,245	2,138,305	2,122,049	25,178,572	13,661,056

Year	Other sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	46,484,294	$24,376,333	103,865,930	$61,238,388	197,454,269	$115,529,786
1928	45,015,917	23,490,020	111,381,151	63,075,531	209,118,868	119,207,937
1929	49,677,021	27,293,305	123,318,851	72,034,622	222,571,905	132,835,979
1930	44,873,138	24,112,490	113,393,108	65,454,990	197,051,726	115,176,543
1931	35,498,067	18,134,396	88,986,218	49,583,574	153,479,044	86,280,320

Sand and gravel imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1927	736, 271	$302, 551	421, 243	$557, 644
1928	788, 222	392, 111	737, 368	638, 288
1929	1, 666, 387	751, 602	486, 378	809, 831
1930	1, 832, 850	719, 345	323, 090	570, 107
1931	420, 721	303, 901	217, 870	418, 441

SAND-LIME BRICK

Sand-lime brick produced in the United States, 1927–1931 [1]

Year	Number of operators	Thousands	Value	Year	Number of operators	Thousands	Value
1927	47	319, 618	$3, 645, 842	1930	37	191, 193	$1, 950, 709
1928	41	313, 553	3, 654, 590	1931	31	143, 673	1, 236, 825
1929	40	269, 584	2, 909, 635				

[1] According to Bureau of the Census.

Imports of sand-lime brick have been recorded as follows: 1927, none; 1928, 1,707,000 brick, valued at $8,628; 1929, 675,000 brick, $6,583; 1930, 3,000 brick, $39; 1931, not separately recorded.

Exports are not separately recorded.

SELENIUM

Most of the selenium produced is a by-product in the electrolytic refining of copper.

Selenium, produced in the United States, sold in 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	284, 508	$491, 996	1930	278, 309	$454, 911
1928	362, 697	607, 382	1931	292, 234	386, 255
1929	344, 288	568, 265			

Selenium and selenium salts imported for consumption in the United States, 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	15, 286	$28, 199	1930	680	$988
1928	18, 622	33, 998	1931	2, 189	2, 777
1929	3, 592	5, 971			

Exports of selenium are not separately recorded.

SILICA

Quartz sold or used by producers in the United States, 1927–1931

Year	Crude		Ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	18, 504	$124, 021	3, 640	$70, 019	22, 144	$194, 040
1928	15, 363	79, 229	6, 835	130, 104	22, 198	209, 333
1929	13, 104	59, 257	7, 877	146, 502	20, 981	205, 759
1930	7, 362	32, 531	5, 794	88, 758	13, 156	121, 289
1931	4, 460	19, 208	3, 391	49, 895	7, 851	69, 103

Silica sold or used by producers in the United States for pottery, paints, fillers, polishers, abrasives, and other uses, 1930 and 1931

Material	1930		1931	
	Short tons	Value	Short tons	Value
Quartz (vein quartz, pegmatite, and quartzite)	13, 156	$121, 289	7, 851	$69, 103
Sand and sandstone [1]	241, 947	1, 566, 815	183, 880	1, 196, 425
Tripoli (including rottenstone) (ground and otherwise prepared)	32, 439	507, 505	26, 682	310, 131
Diatomite	(2)	(2)	(2)	(2)
	(2)	(2)	(2)	(2)

[1] Includes only finely ground material. Figures probably incomplete.
[2] Bureau of Mines not at liberty to publish figures for diatomite.

Imports of "silica, n. s. p. f." have been recorded as follows: 1931, 174 short tons, valued at $2,639; 1930 (June 18 to December 31), 63 tons, $1,141; not separately recorded prior to change in tariff. Imports of "crude silica" have been recorded as follows: 1931, 1930, 1929, and 1928, none; 1927, 12 short tons, valued at $175. Imports of "silica for use as pigment" have been recorded as follows: 1930, 1929, and 1928, none; 1927, 22 short tons, valued at $535; similar imports not separately recorded for 1931. The Bureau of Foreign and Domestic Commerce records imports of "flint, flints, and flint stones, unground," from several countries. These imports are partly flint pebbles for use in grinding mills and partly material for uses such as are listed above. The figures can not be accurately separated.

"Flint, flints, and flint stones, unground" imported for consumption in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	15, 191	$93, 658	1930	6, 856	$62, 463
1928	15, 719	144, 313	1931	6, 291	54, 623
1929	14, 097	127, 457			

No exports of silica are reported.

SILVER

[See Gold and silver]

SLATE

Slate sold by producers in the United States, 1927–1931, by uses

Year	Roofing slate		Mill stock		Slate for other uses [1]	Total	
	Number of squares (100 square feet)	Value	Square feet	Value		Short tons (approximate)	Value
1927	468, 560	$4, 949, 940	9, 287, 680	$3, 519, 386	$2, 911, 410	692, 040	$11, 380, 736
1928	483, 280	5, 411, 332	9, 220, 170	3, 408, 304	2, 652, 655	646, 360	11, 472, 291
1929	462, 120	4, 920, 766	9, 936, 480	3, 702, 145	2, 622, 267	670, 070	11, 245, 178
1930	340, 140	3, 359, 939	7, 917, 220	2, 755, 530	1, 796, 149	463, 610	7, 911, 618
1931	277, 700	2, 364, 861	5, 794, 380	1, 754, 054	1, 379, 421	368, 420	5, 498, 336

[1] Chiefly slate granules.

Value of slate sold by producers in the United States, 1927–1931, by States

State	1927	1928	1929	1930	1931
California	(1)	(1)	(1)	$41, 377	$45, 661
Maine	$549, 952	$551, 242	$653, 627	506, 322	257, 619
Maryland	205, 812	187, 830	214, 770	(1)	(1)
New York	802, 437	1, 052, 363	838, 531	438, 619	325, 476
Pennsylvania	4, 769, 432	4, 786, 355	4, 798, 200	3, 634, 258	2, 791, 752
Vermont	4, 108, 911	3, 981, 928	3, 704, 894	2, 463, 241	1, 508, 518
Virginia	[2] 398, 612	[2] 458, 153	[2] 434, 628	[2] 303, 335	[2] 185, 638
Undistributed [3]	[4] 545, 580	[4] 454, 420	[4] 600, 528	[4] 524, 466	[4] 383, 672
	11, 380, 736	11, 472, 291	11, 245, 178	7, 911, 618	5, 498, 336

[1] Included under "Undistributed."

[2] Exclusive of value of granules, etc., which is included under "Undistributed."

[3] 1927: California, Georgia, and Tennessee; 1928: Arkansas, California, Georgia, and Tennessee; 1929: Arkansas, California, Georgia, and New Jersey; 1930: Arkansas, Georgia, Maryland, and New Jersey; 1931: Arkansas, Georgia, and Maryland.

[4] Includes also value of granules, etc., for Virginia.

Slate sold by producers in the United States, 1930 and 1931, by uses

Use	1930		1931	
	Quantity	Value	Quantity	Value
Roofing squares	340, 140	$3, 359, 939	277, 700	$2, 364, 861
Approximate equivalent in short tons	127, 080		103, 210	
Electrical square feet	928, 760	711, 578	492, 640	333, 032
Approximate equivalent in short tons	7, 690		4, 000	
Structural and sanitary square feet	2, 498, 340	960, 190	1, 648, 200	622, 699
Approximate equivalent in short tons	19, 190		13, 820	
Grave vaults and covers square feet	350, 440	85, 047	392, 180	92, 830
Approximate equivalent in short tons	3, 290		3, 610	
Blackboards and bulletin boards square feet	3, 092, 880	921, 735	2, 357, 070	640, 593
Approximate equivalent in short tons	7, 830		6, 230	
Billiard-table tops square feet	143, 440	57, 750	110, 730	48, 663
Approximate equivalent in short tons	1, 270		980	
School slates pieces	1, 688, 540	19, 230	1, 483, 600	16, 237
Approximate equivalent in square feet	903, 360		793, 560	
Approximate equivalent in short tons	850		800	
Flagstones, walk ways, etc square feet	895, 230	100, 732	765, 620	66, 904
Approximate equivalent in short tons	6, 710		5, 790	
Granules and "flour" short tons	289, 700	1, 695, 417	229, 980	1, 312, 517
Total (quantities approximate, in short tons)	463, 610	7, 911, 618	368, 420	5, 498, 336

Value of slate imported for consumption in the United States, 1927–1931

1927	$78, 909	1930	$48, 065
1928	44, 778	1931	46, 581
1929	95, 073		

Roofing slate exported from the United States, 1927–1931

Year	Number of squares	Value	Year	Number of squares	Value
1927	6, 798	$80, 171	1930	5, 278	$64, 343
1928	12, 236	119, 187	1931	4, 174	45, 020
1929	10, 376	121, 367			

The following figures for exports of slate other than roofing were collected by the Bureau of Mines from shippers of the products named.

Slate other than roofing exported from the United States, 1929–1931, by uses

Use	1929		1930		1931	
	Quantity	Value	Quantity	Value	Quantity	Value
School slates cases [1]	19, 570	$108, 135	16, 280	$95, 935	11, 470	$57, 746
Electrical slate square feet	16, 720	18, 037	18, 830	20, 406	6, 950	4, 026
Blackboards do	188, 720	74, 610	177, 760	59, 810	183, 130	62, 883
Billiard tables do	20, 150	34, 455	15, 760	9, 802	25, 730	12, 480
Structural do	18, 390	15, 882	12, 670	5, 280	20, 360	6, 930
Slate granules and "flour" short tons	14, 250	84, 185	27, 540	162, 000	13, 880	79, 000
		335, 304		353, 233		223, 065

[1] Cases weigh from 130 to 165 pounds each; average is 135 pounds.

SOAPSTONE

[See Talc and soapstone]

SODIUM SALTS (NATURAL)

In addition to common salt, figures for which are given on page A69, the following quantities of other natural sodium salts (including carbonates, sulphates, and borates) and colemanite have been shipped by the producers.

Sodium salts (other than NaCl), derived from natural sources in the United States, shipped by producers, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	145, 770	$3, 834, 324	1930	297, 440	$6, 897, 504
1928	206, 380	5, 272, 228	1931	289, 590	6, 352, 971
1929	275, 190	6, 107, 666			

Borates (colemanite and naturally occurring sodium borates) shipped by producers in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	109, 080	$3, 473, 399	1930	177, 360	$5, 351, 999
1928	131, 000	3, 999, 773	1931	178, 550	4, 931, 295
1929	169, 870	4, 515, 375			

STEEL

[See Iron ore, pig iron, and steel]

STONE

Stone sold or used by producers in the United States, 1927–1931, by varieties

Year	Granite		Basalt and related rocks (trap rock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	10, 706, 740	$35, 287, 206	13, 210, 570	$17, 399, 949	600, 060	$15, 625, 872	99, 662, 270	$112, 439, 824
1928	9, 556, 500	33, 994, 527	15, 327, 760	19, 693, 945	579, 490	16, 402, 986	96, 864, 650	110, 231, 974
1929	10, 826, 730	34, 225, 110	14, 871, 780	18, 946, 197	553, 660	16, 545, 312	100, 686, 960	113, 906, 071
1930	10, 047, 430	30, 423, 853	14, 532, 250	17, 053, 031	477, 240	12, 905, 596	88, 741, 440	100, 002, 114
1931	8, 068, 470	25, 973, 510	12, 552, 880	13, 822, 835	350, 420	10, 419, 834	66, 751, 040	71, 875, 886

Year	Sandstone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	5, 050, 600	$10, 923, 035	7, 114, 890	$6, 971, 336	136, 345, 130	$198, 647, 222
1928	4, 716, 530	10, 498, 440	6, 824, 580	5, 998, 825	133, 869, 510	196, 820, 697
1929	5, 790, 200	11, 023, 981	8, 380, 250	8, 046, 091	141, 109, 580	202, 692, 762
1930	4, 594, 310	10, 285, 391	8, 603, 670	8, 278, 626	126, 996, 340	178, 948, 611
1931	4, 581, 780	7, 575, 320	5, 628, 590	5, 418, 242	97, 933, 180	135, 085, 627

[1] Includes mica schist, conglomerate, argillite, various light-colored volcanic rocks, serpentine not used as marble, and such other stone as can not be properly classed in any of the main groups.

Stone sold or used by producers in the United States, 1930 and 1931, by uses

Use	1930		1931	
	Quantity	Value	Quantity	Value
Building stone ... cubic feet	30, 169, 270	$39, 111, 527	21, 461, 440	$28, 111, 058
Approximate equivalent in short tons	2, 321, 650		1, 669, 440	
Monumental stone ... cubic feet	3, 517, 870	13, 157, 550	2, 869, 150	9, 634, 168
Approximate equivalent in short tons	290, 720		236, 650	
Paving blocks ... number	31, 586, 260	2, 669, 511	22, 440, 590	1, 938, 158
Approximate equivalent in short tons	294, 560		197, 020	
Curbing ... cubic feet	3, 358, 583	3, 176, 102	2, 135, 690	2, 241, 586
Approximate equivalent in short tons	262, 170		171, 120	
Flagging ... cubic feet	1, 095, 780	705, 775	611, 920	446, 525
Approximate equivalent in short tons	81, 680		50, 020	
Rubble ... short tons	1, 066, 590	921, 937	432, 230	592, 243
Riprap ... do	4, 292, 030	4, 739, 122	4, 222, 570	4, 276, 626
Crushed stone ... do	87, 110, 890	87, 554, 354	72, 624, 410	70, 404, 964
Furnace flux (limestone and marble) ... do	17, 090, 710	12, 362, 159	9, 727, 230	7, 193, 944
Refractory stone (ganister, mica schist, and dolomite) ... short tons	1, 197, 500	1, 406, 776	611, 070	633, 199
Agricultural limestone ... do	2, 542, 100	3, 309, 329	1, 421, 050	2, 117, 141
Manufacturing industries (limestone and marble) ... short tons	6, 021, 200	5, 324, 274	4, 501, 370	3, 842, 158
Other ... do	4, 424, 540	4, 510, 195	2, 069, 000	3, 653, 857
Total (quantities approximate, in short tons)	126, 996, 340	178, 948, 611	97, 933, 180	135, 085, 627

Value of stone imported for consumption in the United States, 1927–1931

1927	$4, 536, 407	1930	$3, 145, 861
1928	3, 491, 353	1931	1, 497, 696
1929	3, 589, 259		

Stone imported for consumption in the United States, 1930 and 1931, by kinds

Kind	1930		1931	
	Quantity	Value	Quantity	Value
Marble, breccia, and onyx:				
In blocks, rough, etc.......cubic feet..	717,436	$1,578,856	252,309	$591,867
Sawed.......do....	797	2,983	148	475
Slabs or paving tiles.......superficial feet..	591,616	254,179	442,189	164,346
All other manufactures		329,279		198,833
Mosaic cubes of marble or onyx:				
Loose		9,383		3,126
Attached to paper		2,774		5,358
		2,177,454		964,005
Granite:				
Dressed.......cubic feet..		226,318	25,913	138,168
Rough.......do....	138,831	202,037	84,428	141,436
		428,355	110,341	279,604
Quartzite.......short tons..	[1] 102,032	[1] 174,334	81,538	132,506
Travertine stone, unmanufactured.......cubic feet..	[1] 74,163	[1] 64,997	85,500	64,521
Stone (other):				
Dressed		23,396		22,413
Rough (monumental or building stone).......cubic feet..	214,424	203,417	26,319	22,868
Rough (other)		73,908		11,779
		300,721		57,060
Grand total		3,145,861		1,497,696

[1] Figures cover period June 18 to Dec. 31; not separately recorded prior to change in tariff.

Value of stone [1] exported from the United States, 1927–1931

Year	Marble in blocks, rough or dressed	Other building or monumental stone (including cement building blocks)	Other manufactures of stone (including other cement manufactures)	Year	Marble in blocks, rough or dressed	Other building or monumental stone (including cement building blocks)	Other manufactures of stone (including other cement manufactures)
1927	$237,233	$851,716	$1,005,636	1930	$375,964	$594,177	$1,066,584
1928	254,266	473,166	1,245,792	1931	141,216	209,353	627,771
1929	394,654	682,632	1,487,993				

[1] Figures not separately recorded for stone and for cement building blocks and for stone and for cement manufactures.

STRONTIUM

No domestic production of strontium ore has been reported since 1918. The canvass has been discontinued.

Strontium ore imported for consumption in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	1,356	$58,711	1930	220	$10,459
1928	759	31,157	1931	(1)	123
1929	973	45,505			

[1] 260 pounds.

Strontium chemicals and ore imported for consumption in the United States, 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	4, 233, 816	$149, 383	1930	2, 153, 788	$104, 807
1928	3, 380, 464	136, 561	1931	1, 742, 714	83, 554
1929	4, 578, 327	196, 233			

No exports of strontium ore or strontium chemicals have been reported.

SULPHUR

Sulphur produced and shipped in the United States, 1927–1931

Year	Produced (long tons)	Shipped		Year	Produced (long tons)	Shipped	
		Long tons	Approximate value			Long tons	Approximate value
1927	2, 111, 618	2, 072, 109	$38, 300, 000	1930	2, 558, 981	1, 989, 917	$35, 800, 000
1928	1, 981, 873	2, 082, 924	37, 500, 000	1931	2, 128, 930	1, 376, 526	24, 800, 000
1929	2, 362, 389	2, 437, 238	43, 800, 000				

Sulphur imported into and exported from the United States, 1927–1931

Year	Imports for consumption		Exports	
	Long tons	Value	Long tons	Value
1927	3, 384	$34, 487	803, 300	$16, 798, 600
1928	4, 787	21, 320	704, 933	15, 051, 841
1929	1, 163	6, 616	872, 846	18, 278, 053
1930	29	1, 523	609, 326	12, 972, 262
1931	----------	----------	419, 728	9, 269, 053

TALC AND SOAPSTONE

Talc sold by producers in the United States, 1927–1931, by classes

Year	Crude		Sawed and manufactured		Ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	5, 706	$25, 365	1, 494	$111, 650	185, 116	$2, 097, 709	192, 316	$2, 234, 724
1928	6, 360	48, 031	936	70, 394	195, 680	2, 419, 569	202, 976	2, 537, 994
1929	11, 228	87, 820	473	140, 928	208, 082	2, 399, 914	219, 783	2, 628, 662
1930	4, 972	48, 913	385	90, 370	174, 028	1, 969, 055	179, 385	2, 108, 338
1931	6, 673	47, 382	181	51, 740	156, 898	1, 753, 350	163, 752	1, 852, 472

Soapstone was sold by producers in the United States in each year from 1927 to 1931, but the Bureau of Mines is not at liberty to publish the figures.

Talc imported for consumption in the United States, 1927–1931

Year	Crude and unground steatite and French chalk		Manufactures (except toilet preparations) wholly or partly finished		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1927	377	$27, 326	24, 817	$523, 056	25, 194	$550, 382
1928	459	33, 276	26, 590	546, 639	27, 049	579, 915
1929	1, 228	74, 840	29, 949	596, 789	31, 177	671, 629
1930	722	28, 306	25, 057	501, 516	25, 779	529, 822
1931	146	7, 755	23, 335	425, 927	23, 481	433, 682

No material that might be classed as soapstone is imported.

Exports of "toilet powders—talcum powder, face powder, and compact" were valued at $1,244,525 in 1931 and at $1,484,338 in 1930; total quantity not recorded. Exports of talcum powder (in bulk), included in the foregoing total, amounted to 956,050 pounds, valued at $36,410, in 1930; similar exports in 1931 are not separately recorded. Exports of "powders—talcum, face, compact, and bath and other toilet powders" were valued at $1,592,301 in 1929; quantity not recorded. Exports of "talcum and other toilet powders" in 1928 and 1927 were as follows: 1928, 1,568 short tons, valued at $1,605,630; 1927, 1,627 tons, $1,621,068.

TANTALUM

Columbite, mined in the United States, shipped in 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	1, 100	$378	1930	5, 100	$3, 350
1928	34, 899	26, 332	1931	700	490
1929	22, 117	17, 261			

Tantalum ores imported into the United States, 1927–1931 [1]

Year	Pounds	Value	Year	Pounds	Value
1927	[2] 15, 119	$20, 012	1930	[2] 8, 474	$7, 036
1929	[2] 15, 250	19, 418	1931	[3] 6, 288	6, 289

[1] No imports reported for 1928.
[2] Classified as "Ores of ferro-alloying metals (tantalum)."
[3] Classified as "Tantalum and columbium ores."

No separate record of exports is kept.

TELLURIUM

Tellurium is a by-product of the electrolytic refining of copper.

Tellurium produced in the United States and sold by producers, 1927–1931

Year	Produced (pounds)	Sold	
		Pounds	Value
1927	1, 659	1, 003	$1, 913
1928	2, 590	932	1, 731
1929	11, 410	1, 309	2, 710
1930	14, 095	4, 717	$7, 996
1931	(1)	(1)	(1)

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[1] Bureau of Mines not at liberty to publish figures.

Imports and exports of tellurium are not reported.

THORIUM MINERALS

No monazite is known to have been produced in the United States from 1927 to 1931.

Monazite sand and thorium nitrate, oxide, and other salts imported for consumption in the United States, 1927–1931

Year	Monazite sand		Thorium nitrate, oxide, and other salts	
	Pounds	Value	Pounds	Value
1927	1, 193, 920	$41, 029	10, 492	$13, 514
1928	884, 800	24, 151	12, 431	14, 149
1929	1, 153, 600	26, 114	10, 164	11, 384
1930	----------	----------	4, 025	4, 181
1931	3, 395, 840	65, 080	9	48

TIN

Tin mined in the United States (including Alaska), 1927–1931

[Metallic tin obtainable from concentrates produced in tin mining]

Year	Short tons	Value [1]
1927	27	$34, 600
1928	47	47, 400
1929	39	35, 600
1930	17	$10, 500
1931	4	2, 050

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[1] Value calculated at average price per pound of Straits tin in New York, as published by American Metal Market.

No smelter production of metallic tin in the United States has been reported since 1924.

Secondary tin recovered as metal and in alloys and chemical compounds in the United States, 1927–1931

Year	Short tons	Value
1927	36, 900	$46, 302, 100
1928	35, 800	35, 678, 300
1929	34, 300	30, 513, 300
1930	26, 200	$16, 228, 300
1931	19, 800	9, 428, 800

Metallic tin imported for consumption in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	79,679	$100,865,205	1930	90,422	$60,233,644
1928	87,327	86,983,174	1931	73,992	36,723,656
1929	97,583	91,838,781			

Tin content of tin ore (concentrate) imported into the United States, 1927–1931

[General imports]

Year	Short tons	Value	Year	Short tons	Value
1927	137	$79,089	1930	324	$177,120
1928	146	69,227	1931	34	7,117
1929	143	66,609			

Metallic tin (pigs, bars, etc.) of domestic manufacture exported from the United States, 1927–1931 [1]

Year	Short tons	Value	Year	Short tons	Value
1927	1,131	$888,563	1929	884	$781,156
1928	391	325,668	1930	94	59,798

[1] Not separately recorded for 1931.

TITANIUM MINERALS

Titanium minerals produced in the United States, 1927–1931

Year	Rutile concentrates			Ilmenite concentrates		
	Short tons	Percentage of TiO_2	Value	Short tons	Percentage of TiO_2	Value
1927	524	95	$129,861	3,500	50	$44,000
1928	176	93–96	[1] 37,700	918	50	[1] 21,000
1929	(2)	(2)	(2)	(2)	(2)	(2)
1930	(2)	(2)	(2)	(2)	(2)	(2)
1931	(2)	(2)	(2)	(2)	(2)	(2)

[1] Estimate by Bureau of Mines.
(2) Bureau of Mines not at liberty to publish figures.

No imports of "titanium steel-hardening" ores have been recorded since 1918, although ilmenite is known to have been imported from Senegal, West Africa; from Brazil; from Travancore, India; and possibly from other places. Such imports were not separately recorded by the Bureau of Foreign and Domestic Commerce until 1928, when 17,224 short tons of ilmenite, valued at $79,640, were imported. Imports in 1929 to 1931 were recorded as follows: 25,072 tons of ilmenite, $104,887, and 6 tons of rutile, $1,463, in 1929; 24,973 tons of ilmenite, $150,466, and 3 tons of rutile, $974, in 1930; and 33,440 tons of ilmenite, $144,951, and 1 ton of rutile, $189, in 1931. For imports of ferrotitanium see Ferro-alloys.

No separate record of exports of titanium, "titanium steel-hardening" ores, or ferrotitanium is kept.

TRIPOLI

[See Abrasive materials]

TUNGSTEN

Concentrated tungsten ores (reduced to equivalent of 60 per cent of tungsten trioxide), produced in the United States, sold in 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	1,164	$724,000	1930	702	$509,000
1928	1,208	753,900	1931	1,404	928,000
1929	830	654,000			

Tungsten content of tungsten-bearing ore imported for consumption in the United States, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	1,085	$540,409	1930	1,847	$1,534,769
1928	1,428	672,199	1931	84	48,288
1929	2,987	1,703,711			

For imports and exports of tungsten and ferrotungsten see Ferro-alloys.

URANIUM AND VANADIUM ORES

Uranium and vanadium ores were shipped from mines in the United States each year from 1927 to 1931, but the Bureau of Mines is not at liberty to publish figures for such shipments.

Value of uranium salts and oxide, including radium salts, imported for consumption in the United States, 1927–1931

1927	$452,633	1930	$1,232,389
1928	715,447	1931	965,072
1929	923,816		

No imports of "uranium-radium ore (steel-hardening)" were recorded for 1927 to 1931.

Vanadium ore (steel-hardening) imported for consumption in the United States, 1927–1931 [1]

Year	Short tons	Value	Year	Short tons	Value
1927	6,943	$561,051	1929	9,760	$794,734
1928	552	49,771	1930	5,788	491,633

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[1] No imports reported for 1931.

For imports of ferrovanadium see Ferro-alloys.

No separate record is kept of vanadium exports. For exports of ferrovanadium see Ferro-alloys.

ZINC [1]

Primary zinc produced in the United States from domestic ores, 1927–1931

Year	Short tons	Value	Year	Short tons	Value
1927	576,960	$73,851,000	1930	489,361	$46,979,000
1928	591,525	72,166,000	1931	291,996	22,192,000
1929	612,136	80,802,000			

[1] For prices of zinc, see statement on p. A16.

Primary zinc produced in the United States, 1927–1931, by sources of ore, in short tons

Source	1927	1928	1929	1930	1931
United States	576,960	591,525	612,136	489,361	291,996
Foreign (all from Mexico)	15,556	11,056	13,311	8,684	----------
	592,516	602,581	625,447	498,045	291,996

Primary zinc produced in the United States, 1927–1931, by method of reduction and by location of reduction plant, in short tons

	1927	1928	1929	1930	1931
Distilled:					
Arkansas	26,317	20,505	17,923	13,917	3,362
Illinois	102,768	103,765	110,791	94,582	65,948
Kansas	33,144	33,923	37,795	13,682	4,660
Oklahoma	120,801	106,557	111,683	79,742	26,924
Pennsylvania	106,099	108,802	108,167	101,916	65,445
Other States	90,758	68,869	82,853	63,040	43,759
Electrolytic:					
Idaho	----------	1,939	16,582	9,509	8,466
Illinois	----------	----------	1,634	8,749	10,342
Montana	112,629	158,221	138,019	112,908	63,090
	592,516	602,581	625,447	498,045	291,996

Secondary zinc recovered as metal in the United States, 1927–1931, in short tons

Year	Redistilled	Remelted	Recovered in alloys, excluding old brass remelted	Recovered in remelted brass (estimate)
1927	42,784	22,016	12,400	63,200
1928	48,666	22,034	12,500	66,000
1929	47,348	18,052	11,600	65,670
1930	[1] 34,849	14,451	7,700	42,300
1931	[2] 21,625	13,175	7,400	30,000

[1] Includes 22 tons of secondary electrolytic.
[2] Includes 312 tons of secondary electrolytic.

Zinc imported for consumption in the United States, 1927–1931

Year	Blocks or pigs		Sheets		Old		Zinc dust		Manufactures	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1927	39	$5,089	1	$271	19	$1,443	(1)	$114	$91,519	$98,436
1928	(1)	66	3	2,556	3	260	146	14,147	115,784	132,813
1929	226	21,502	(1)	52	(1)	20	159	19,543	128,395	169,512
1930	281	25,389	65	6,420	[2] 35	[2] 1,968	76	7,086	76,062	116,925
1931	274	14,793	20	2,283	(1)	35	1	97	13,591	30,799

[1] Less than 1 ton.

[2] Includes 33 tons of dross and skimmings, valued at $1,829, imported June 18 to December 31; not separately recorded prior to change in tariff.

Zinc content of zinc ores [1] imported for consumption in the United States, 1927–1931 [2]

Year	Short tons	Value	Year	Short tons	Value
1927	154	$10,401	1930	590	$46,549
1928	344	19,121	1931	966	52,723
1929	2,631	208,428			

[1] Classification as follows: 1927 to June 17, 1930, "Zinc ores (zinc content)"; June 18, 1930, to Dec. 31, 1931, "Zinc ores (except pyrites, not more than 3 per cent zinc) (zinc content)."

[2] Content of ore imported duty free and containing less than 10 per cent of zinc is separately recorded but is excluded from figures as zinc content is not recovered.

Zinc exported from the United States, 1927–1931

Year	Slabs (domestic and foreign)[1]		Sheets (domestic)	
	Short tons	Value	Short tons	Value
1927	45,695	$6,035,382	3,922	$869,425
1928	25,289	3,013,679	4,325	906,515
1929	14,411	1,879,039	5,265	1,075,000
1930	4,633	450,417	3,868	761,007
1931	643	51,010	2,759	461,130

[1] Domestic and foreign not separately recorded.

ZINC RESIDUUM

[See Manganiferous zinc residuum]

ZIRCONIUM MINERALS

Shipments of zircon from Pablo Beach, Fla., in 1927 amounted to 3,646 short tons. The value of this zircon is estimated by the Bureau of Mines as $364,600. No shipments have been reported since 1927.

Zirconium ores (steel-hardening) imported for consumption in the United States, 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	4,488	$182	1930	3,038,599	$40,416
1928	863,685	9,788	1931	1,124,034	18,945
1929	2,689,120	35,416			

STATE TABLES

Mineral production of Alabama in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asphalt (native)........short tons..	(1)	(1)	(1)	(1)
Bauxite........long tons..	(1)	(1)	(1)	(1)
Cement........barrels..	[2] 4,689,516	[2] $5,829,818	[2] 4,476,400	[2] $5,283,085
Clay products........	....	[3] 2,295,334	....	[3] 1,441,345
Clay, raw........short tons..	86,698	[4] 124,791	64,649	[4] 84,480
Coal........do....	15,570,058	31,616,000	11,998,781	21,866,000
Cobalt ore........do....	....	....	(1)	(1)
Coke........do....	3,986,920	[4] 10,741,937	2,943,143	[4] 8,023,595
Ferro-alloys........long tons..	(1 4)	(1 4)	(1 4)	(1 4)
Gold........troy ounces..	22	450	20	407
Graphite, crystalline........pounds..	(1)	(1)	(1)	(1)
Iron ore........long tons..	5,637,678	11,015,336	3,629,997	6,155,995
Iron, pig........do....	2,294,513	[4] 31,083,905	1,617,331	[4] 20,024,541
Lime........short tons..	164,822	929,302	137,423	823,437
Manganiferous ore........long tons..	321	2,618	1,321	5,848
Mica, sheet........pounds..	(1)	(1)	(1)	(1)
Mineral waters........gallons sold..	(5)	(5)	(5)	(5)
Sand and gravel........short tons..	1,515,160	901,088	1,327,686	720,143
Silver........troy ounces..	3	1	3	1
Stone........short tons..	967,320	2,111,340	[6] 546,810	[6] 1,671,539
Miscellaneous [7]........	....	1,919,340	....	2,240,634
Total value, eliminating duplications........	....	55,461,985	....	38,506,558

[1] Value included under "Miscellaneous."
[2] Exclusive of puzzolan, value for which is included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1," "2," and "6" above.

Mineral production of Alaska in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Arsenic........short tons..	(1)	(1)	(1)	(1)
Coal........do....	120,100	$631,000	105,900	$556,000
Copper........pounds..	32,651,000	4,244,630	22,614,000	2,057,874
Gold........troy ounces..	410,027	8,476,000	459,901	9,507,000
Lead........short tons..	1,365	136,500	1,661	122,877
Mercury........flasks (76 pounds)..	(2)	(2)	(2)	(2)
Natural gas........M cubic feet..	(2)	(2)	(2)	(2)
Natural gasoline........gallons..	39,000	5,000	32,000	5,000
Ores (crude), etc.:				
Copper........short tons..	531,000	(3)	89,818	(3)
Dry and siliceous (gold and silver)....do....	3,936,000	(3)	4,195,000	(3)
Petroleum........barrels..	(2)	(2)	(2)	(2)
Platinum and allied metals........troy ounces..	462	30,547	39	1,716
Silver........do....	408,570	157,299	352,000	102,080
Tin (metallic equivalent)........short tons..	15	9,300	4	2,000
Miscellaneous [4]........	....	16,959	....	16,510
Total value, eliminating duplications........	....	13,707,235	....	12,371,057

[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] Not valued as ore; value of recoverable metal content included under the metals.
Includes minerals indicated by "2" above.

Mineral production of Arizona in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asbestos short tons	683	$177, 912	(1)	(1)
Barite do			2, 139	$14, 275
Clay products		[2] 236, 653		[2] 154, 479
Clay, raw short tons	(1 3)	(1 3)	(1 3)	(1 3)
Coal do	9, 084	29, 000	7, 120	42, 000
Copper pounds	576, 190, 607	74, 904, 779	401, 344, 909	36, 522, 387
Feldspar (crude) long tons			(1)	(1)
Gems and precious stones		(4)		(4)
Gold troy ounces	169, 390	3, 501, 610	126, 186	2, 608, 495
Gypsum short tons	(1)	(1)	(1)	(1)
Iron ore long tons	923	(1)		
Lead short tons	4, 246	424, 581	982	72, 672
Lime do	35, 642	317, 881	22, 567	222, 785
Manganese ore long tons	364	(1)	40	600
Manganiferous ore do	48	(1)		
Mercury flasks (76 pounds)	(1)	(1)	(1)	(1)
Molybdenum pounds			(1)	(1)
Ores (crude), etc.:				
Copper short tons	19, 703, 349	(5)	13, 606, 755	(5)
Copper-lead do	1, 309	(5)	218	(5)
Dry and siliceous (gold and silver) do	53, 753	(5)	69, 686	(5)
Lead do	21, 807	(5)	13, 951	(5)
Lead-zinc do	22, 701	(5)		
Pumice do	110	770	50	500
Sand and gravel do	402, 796	361, 326	388, 697	312, 128
Silica (quartz) do			(1)	(1)
Silver troy ounces	5, 540, 732	2, 133, 182	3, 245, 311	941, 140
Sodium sulphate from natural sources short tons	(1)	(1)	(1)	(1)
Stone do	589, 160	516, 886	467, 950	358, 419
Sulphuric acid [6] do	(1 3)	(1 3)	(1 3)	(1 3)
Tungsten ore (60 per cent concentrates) do	1	(1)	98	62, 166
Vanadium ores do	(1)	(1)		
Zinc do	815	78, 264		
Miscellaneous [7]		556, 421		497, 609
Total value, eliminating duplications		82, 933, 802		41, 602, 929

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] From copper smelting.
[7] Includes minerals indicated by "1" above.

Mineral production of Arkansas in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Bauxite long tons	315, 273	$1, 823, 389	186, 697	$1, 081, 450
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[2] 1, 074, 103		[2] 494, 494
Clay, raw short tons	192	[3] 960	319	[3] 1, 116
Coal do	1, 533, 434	5, 153, 000	1, 153, 555	3, 511, 000
Gems and precious stones		(4)		(4)
Iron ore sold for magnets long tons	5	(1)	6	(1)
Lead short tons	53	5, 300	78	5, 772
Lime do	30, 349	241, 938	22, 520	153, 733
Manganese ore long tons	3, 276	58, 172	4, 028	80, 915
Manganiferous ore do	12, 645	96, 964	2, 230	(1)
Mercury flasks (76 pounds)			(1)	(1)
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Natural gas M cubic feet	18, 585, 000	3, 540, 000	13, 300, 000	2, 696, 000
Natural gasoline gallons	30, 637, 000	1, 757, 000	26, 282, 000	921, 000
Oilstones short tons	(1)	(1)	59	38, 379
Ores (lead and zinc) do	(5)	(5)	(5)	(5)
Petroleum barrels	19, 702, 000	17, 390, 000	14, 791, 000	7, 200, 000
Sand and gravel short tons	2, 720, 756	1, 555, 408	1, 555, 235	1, 044, 276
Slate		(1)		(1)
Stone short tons	1, 034, 920	1, 203, 729	390, 710	410, 091
Tripoli do	4, 364	83, 835	(1)	(1)
Miscellaneous [6]		918, 638		1, 055, 269
Total value, eliminating duplications		34, 901, 476		18, 692, 379

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Figures not available.
[6] Includes minerals indicated by "1" above.

Mineral production of California in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asbestos ... short tons	(1)	(1)	---	---
Asphalt (native) ... do	(1)	(1)	(1)	(1)
Barite ... do	19,517	$114,310	17,500	$102,085
Borates ... do	177,360	5,351,999	178,550	4,931,295
Briquets, fuel ... do	(1 2)	(1 2)	(1 2)	(1 2)
Bromine ... pounds	(1)	(1)	(1)	(1)
Calcium chloride ... short tons	(1)	(1)	(1)	(1)
Cement ... barrels	10,438,479	15,241,089	7,496,080	11,557,442
Chromite ... long tons	80	1,905	268	3,509
Clay products	---	[3] 16,209,437	---	[3] 10,334,517
Clay, raw ... short tons	527,258	[2] 930,381	281,006	[2] 580,749
Coal ... do	(1)	(1)	12,685	73,000
Copper ... pounds	27,285,272	3,547,085	12,931,995	1,176,812
Diatomite ... short tons	(1)	(1)	(1)	(1)
Feldspar (crude) ... long tons	6,519	54,941	4,465	30,857
Fuller's earth ... short tons	---	---	(1)	(1)
Gems and precious stones	---	(4)	---	(4)
Gold ... troy ounces	457,200	9,451,162	523,135	10,814,162
Gypsum ... short tons	(1)	(1)	90,899	472,015
Iodine ... pounds	(1)	(1)	(1)	(1)
Lead ... short tons	1,780	177,978	1,879	139,018
Lime ... do	51,302	498,795	41,371	389,696
Lithium minerals ... do	(1)	(1)	---	---
Magnesite ... do	(1)	(1)	(1)	(1)
Magnesium salts (natural) ... pounds	(1)	(1)	(1)	(1)
Manganese ore ... long tons	162	(1)	40	(1)
Marl, calcareous ... short tons	(1)	(1)	3,780	16,734
Mercury ... flasks (76 pounds)	11,451	1,316,968	13,448	1,174,696
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	334,789,000	69,071,000	305,930,000	76,345,000
Natural gasoline ... gallons	829,713,000	57,974,000	680,339,000	29,505,000
Ores (crude), etc.:				
Copper ... short tons	857,786	(5)	473,389	(5)
Copper-lead-zinc ... do	---	---	9,911	(5)
Dry and siliceous (gold and silver) ... do	730,712	(5)	1,008,411	(5)
Lead ... do	6,652	(5)	5,536	(5)
Peat ... do	(4)	(4)	(4)	(4)
Pebbles for grinding ... do	15	127	21	171
Petroleum ... barrels	227,329,000	271,699,000	188,830,000	135,960,000
Platinum and allied metals ... troy ounces	213	14,106	213	9,521
Potassium salts ... short tons	(1)	(1)	(1)	(1)
Pumice ... do	11,993	144,621	11,344	108,543
Pyrites ... long tons	(1)	(1)	(1)	(1)
Salt ... short tons	350,370	2,080,133	334,900	2,000,567
Sand and gravel ... do	12,604,051	7,354,506	9,673,523	6,222,779
Sand and sandstone (finely ground) ... do	(1)	(1)	(1)	(1)
Silica (quartz) ... do	2,895	22,762	1,553	16,654
Silver ... troy ounces	1,622,803	624,779	867,818	251,667
Slate	---	41,377	---	45,661
Sodium salts (carbonate, bicarbonate, and trona) from natural sources ... short tons	90,200	1,584,556	78,530	1,223,544
Stone ... do	10,690,030	9,794,870	5,751,820	6,482,202
Sulphur ore ... long tons	(1)	(1)	---	---
Talc ... short tons	14,993	219,246	11,605	180,582
Tungsten ore (60 per cent concentrates) ... do	(1)	(1)	(1)	(1)
Zinc ... do	---	---	80	6,075
Miscellaneous [6]	---	6,464,777	---	5,081,231
Total value, eliminating duplications	---	479,049,507	---	304,538,557

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

Mineral production of Colorado in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel.....short tons			(1 2)	(1 2)
Cement.....barrels	(1)	(1)	(1)	(1)
Clay products		[3] $2, 485, 684		[3] $1, 804, 526
Clay, raw.....short tons	108, 162	[2] 128, 342	65, 268	[2] 84, 159
Coal.....do	8, 196, 910	21, 485, 000	6, 604, 369	15, 944, 000
Coke.....do	458, 443	(1 2)	(1 2)	(1 2)
Copper.....pounds	10, 514, 000	1, 366, 820	8, 165, 000	743, 015
Feldspar (crude).....long tons	1, 933	10, 575	2, 953	14, 927
Ferro-alloys.....do	(1 2)	(1 2)	(1 2)	(1 2)
Fluorspar.....short tons	9, 248	101, 758	529	5, 921
Fuller's earth.....do	(1)	(1)	(1)	(1)
Gems and precious stones		(4)		(4)
Gold.....troy ounces	218, 540	4, 517, 619	233, 300	4, 822, 734
Gypsum.....short tons	(1)	(1)	(1)	(1)
Iron ore.....long tons	32, 247	(1)	26, 202	(1)
Iron, pig.....do	(1 2)	(1 2)	(1 2)	(1 2)
Lead.....short tons	22, 130	2, 213, 000	6, 884	509, 416
Lime.....do	6, 777	73, 156	4, 646	50, 823
Manganiferous ore.....long tons	19, 730	109, 796	3, 685	21, 880
Mica, scrap.....short tons	115	1, 377	113	1, 395
Micaceous minerals (vermiculite).....do	(1)	(1)	(1)	(1)
Mineral paints, zinc and lead pigments.....do	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters.....gallons sold	(4)	(4)	(4)	(4)
Molybdenum.....pounds	(1)	(1)	2, 644, 399	(1)
Natural gas.....M cubic feet	3, 312, 000	958, 000	2, 536, 000	940, 000
Natural gasoline.....gallons	1, 322, 000	69, 000	659, 000	21, 000
Ores (crude), etc.:				
Copper.....short tons	63, 915	(5)	57, 232	(5)
Copper-lead.....do			144	(5)
Dry and siliceous (gold and silver).....do	710, 491	(5)	811, 619	(5)
Lead.....do	20, 482	(5)	5, 410	(5)
Lead-zinc.....do	540, 843	(5)	162, 157	(5)
Petroleum.....barrels	1, 656, 000	1, 480, 000	1, 545, 000	825, 000
Sand and gravel.....short tons	929, 888	442, 303	893, 033	567, 222
Silver.....troy ounces	4, 382, 852	1, 687, 398	2, 195, 914	636, 815
Stone.....short tons	493, 900	878, 656	[6] 343, 520	[6] 565, 443
Sulphur ore.....long tons	(1)	(1)	(1)	(1)
Tungsten ore (60 per cent concentrates).....short tons	47	37, 050	98	73, 563
Uranium and vanadium ores.....do	(1)	(1)	(1)	(1)
Zinc.....do	36, 259	3, 480, 864	16, 187	1, 230, 174
Miscellaneous [7]		13, 177, 309		8, 420, 589
Total value, eliminating duplications		46, 270, 545		32, 970, 230

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[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of marble, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Connecticut in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Clay products	------------	[1] $1,547,524	------------	[1] $1,271,557
Clay, raw ... short tons	608	[2] 4,561	438	[2] 875
Coke ... do	(2 3)	(2 3)	(2 3)	(2 3)
Feldspar (crude) ... long tons	(3)	(3)	(3)	(3)
Lime ... short tons	28,489	282,521	(3)	(3)
Mica:				
Scrap ... do	(3)	(3)	296	5,344
Sheet ... pounds	(3)	(3)	114,318	21,559
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Sand and gravel ... short tons	670,501	446,973	569,136	387,414
Stone ... do	2,436,520	3,187,815	1,986,500	2,463,145
Miscellaneous [5]	------------	2,803,576	------------	3,180,630
Total value, eliminating duplications	------------	5,485,120	------------	4,299,790

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value not included in total value for State.
[3] Value included under "Miscellaneous."
[4] No canvass.
[5] Includes mineral indicated by "3" above.

Mineral production of Delaware in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Clay products	------------	[1] $157,391	------------	(1 2)
Clay, raw ... short tons	(2 3)	(2 3)	(2 3)	(2 3)
Sand and gravel ... do	74,897	55,193	110,678	$64,473
Sand and sandstone (finely ground) ... do	------------	------------	(2)	(2)
Stone ... do	(2)	(2)	(2)	(2)
Miscellaneous [4]	------------	264,182	------------	370,678
Total value, eliminating duplications	------------	424,901	------------	394,579

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] Value not included in total value for State.
[4] Includes minerals indicated by "2" above.

Mineral production of the District of Columbia in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Clay products	------------	[1] $298,441	------------	(1 2)
Sand and gravel ... short tons	(2)	(2)	(2)	(2)
Sand-lime brick ... thousands	(1 2)	(1 2)	------------	------------
Stone ... short tons	(2)	(2)	(2)	(2)
Miscellaneous [3]	------------	989,903	------------	$281,980
Total value, eliminating duplications	------------	1,288,344	------------	281,980

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] Includes minerals indicated by "2" above.

Mineral production of Florida in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement ---- barrels	(1)	(1)	(1)	(1)
Clay products	----	[2] $137,543	----	[2] $38,228
Clay, raw ---- short tons	(1 3)	(1 3)	(1 3)	(1 3)
Fuller's earth ---- do	80,619	1,251,653	(1)	(1)
Lime ---- do	(1)	(1)	(1)	(1)
Mineral waters ---- gallons sold	(4)	(4)	(4)	(4)
Peat ---- short tons	(4)	(4)	(4)	(4)
Phosphate rock ---- long tons	3,248,071	10,790,305	2,061,466	7,202,086
Sand and gravel ---- short tons	496,198	269,161	419,560	242,383
Sand-lime brick ---- thousands	(1 2)	(1 2)	(1 2)	(1 2)
Stone ---- short tons	[5] 1,796,670	[5] 1,490,173	[5] 1,359,460	[5] 1,219,214
Miscellaneous [6]	----	1,854,445	----	2,434,244
Total value, eliminating duplications	----	15,484,206	----	10,850,806

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Georgia in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asbestos ---- short tons	561	$10,000	326	$3,839
Barite ---- do	41,746	230,769	(1)	(1)
Bauxite ---- long tons	(1)	(1)	(1)	(1)
Cement ---- barrels	(1)	(1)	(1)	(1)
Clay products	----	[2] 2,439,250	----	[2] 1,126,989
Clay, raw ---- short tons	289,880	[3] 2,061,209	277,802	[3] 1,656,433
Coal ---- do	7,092	18,000	21,580	45,000
Fuller's earth ---- do	(1)	(1)	(1)	(1)
Gold ---- troy ounces	203	4,194	88	1,827
Iron ore ---- long tons	52,221	147,964	20,745	51,513
Lime ---- short tons	7,455	50,655	5,139	34,339
Manganese ore ---- long tons	18,897	(1)	6,491	(1)
Manganiferous ore ---- do	12,009	(1)	11,652	(1)
Mica:				
Scrap ---- short tons	(1)	(1)	30	253
Sheet ---- pounds	(1)	(1)	8,941	1,176
Micaceous minerals (chlorite schist) ---- short tons	(1)	(1)	(1)	(1)
Mineral waters ---- gallons sold	(4)	(4)	(4)	(4)
Ore (dry and siliceous) (gold and silver) ---- short tons	200	(5)	300	(5)
Sand and gravel ---- do	586,929	228,396	509,068	204,593
Silver ---- troy ounces	23	9	12	3
Slate	----	(1)	----	(1)
Stone ---- short tons	[6] 772,650	[6] 2,374,994	1,516,270	6,040,740
Talc ---- do	(1)	(1)	(1)	(1)
Tripoli ---- do	(1)	(1)	----	----
Miscellaneous [7]	----	7,326,614	----	2,780,321
Total value, eliminating duplications	----	12,830,845	----	10,290,593

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of marble, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Idaho in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement ..... barrels	(1)	(1)	(1)	(1)
Clay products	----	[2] $122,710	----	[2] $94,139
Clay, raw ..... short tons	1,556	[3] 7,221	259	[3] 3,036
Coal ..... do	(1)	(1)	2,734	7,400
Copper ..... pounds	3,111,555	404,502	1,144,915	104,187
Diatomite ..... short tons	50	500	(1)	(1)
Fuller's earth ..... do	----	----	(1)	(1)
Gems and precious stones	----	(4)	----	(4)
Gold ..... troy ounces	21,445	443,309	18,361	379,563
Lead ..... short tons	134,058	13,405,798	99,365	7,352,981
Lime ..... do	2,463	25,156	880	8,580
Manganiferous ore ..... long tons	1,450	(1)	578	(1)
Ores (crude), etc.:				
Copper ..... short tons	33,129	(5)	548	(5)
Copper-lead ..... do	161,863	(5)	195,643	(5)
Dry and siliceous (gold and silver) ..... do	33,259	(5)	24,371	(5)
Lead ..... do	1,051,962	(5)	701,230	(5)
Lead-zinc ..... do	663,880	(5)	378,135	(5)
Zinc ..... do	807	(5)	----	----
Phosphate rock ..... long tons	59,932	234,543	60,978	234,781
Sand and gravel ..... short tons	353,839	169,755	740,189	358,046
Silver ..... troy ounces	9,420,639	3,626,946	7,220,923	2,094,068
Stone ..... short tons	536,810	513,752	884,130	841,258
Zinc ..... do	37,649	3,614,312	19,569	1,487,214
Miscellaneous [6]	----	342,376	----	215,210
Total value, eliminating duplications	----	22,903,659	----	13,177,427

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

Mineral production of Illinois in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement ..... barrels	[1] 7,951,680	[1] $10,519,162	[1] 6,425,909	[1] $5,342,446
Clay products	----	[2] 17,520,430	----	[2] 10,357,208
Clay, raw ..... short tons	184,555	[3] 371,645	100,028	[3] 200,995
Coal ..... do	53,731,230	93,484,000	44,303,295	75,527,000
Coke ..... do	3,576,577	[3] 21,379,784	2,478,984	[3] 14,042,457
Fluorspar ..... do	44,134	836,473	28,072	468,386
Fluorspar, optical ..... pounds	1,440	(4)	----	----
Fuller's earth ..... short tons	(4)	(4)	(4)	(4)
Grindstones ..... do	(4)	(4)	(4)	(4)
Iron, pig ..... long tons	3,050,743	[3] 54,290,144	1,727,834	[3] 29,178,510
Lead ..... short tons	248	24,800	205	15,170
Lime ..... do	89,709	721,143	96,105	718,952
Marl, calcareous ..... do	(4)	(4)	(4)	(4)
Mineral paints, zinc and lead pigments ..... do	11,239	[3] 1,385,464	10,298	[3] 1,260,323
Mineral waters ..... gallons sold	(5)	(5)	(5)	(5)
Natural gas ..... M cubic feet	2,890,000	505,000	2,130,000	999,000
Natural gasoline ..... gallons	6,867,000	420,000	5,024,000	204,000
Ore (lead and zinc) ..... short tons	(6)	(6)	(6)	(6)
Peat ..... do	(5)	(5)	(5)	(5)
Petroleum ..... barrels	5,736,000	9,100,000	5,039,000	4,500,000
Pyrites ..... long tons	----	----	(4)	(4)
Sand and gravel ..... short tons	17,398,693	8,382,025	10,297,943	5,209,474
Sand and sandstone (finely ground) ..... do	44,033	232,141	34,555	177,146
Silver ..... troy ounces	1,797	692	1,300	377
Stone ..... short tons	7,590,920	5,939,297	5,323,030	3,970,428
Sulphuric acid (60° Baumé)[7] ..... do	243,772	[3] 2,347,524	195,058	[3] 1,712,609
Tripoli ..... do	9,954	116,307	12,651	87,481
Zinc ..... do	9	864	----	----
Miscellaneous [8]	----	509,084	----	488,868
Total value, eliminating duplications	----	148,311,418	----	108,065,936

[1] Exclusive of natural cement, value for which is included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] Value included under "Miscellaneous."
[5] No canvass.
[6] No ore milled in Northern Illinois; lead output of Southern Illinois is by-product of fluorspar milling.
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "4" above.

Mineral production of Indiana in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement ---- barrels	(1)	(1)	(1)	(1)
Clay products		[2] $12,032,852		[2] $5,952,237
Clay, raw ---- short tons	253,795	[3] 216,098	197,582	[3] 128,860
Coal ---- do	16,489,962	26,178,000	14,295,165	20,735,000
Coke ---- do	4,984,620	[3] 12,166,488	2,757,135	[3] 16,431,416
Iron, pig ---- long tons	3,195,517	[3] 52,869,137	1,721,925	[3] 28,458,099
Lime ---- short tons	87,965	600,784	81,925	502,232
Mineral paints, zinc and lead pigments ---- do	(1 3)	(1 3)	(1 3)	(1 3)
Mineral waters ---- gallons sold	(4)	(4)	(4)	(4)
Natural gas ---- M cubic feet	1,217,000	676,000	1,337,000	699,000
Natural gasoline ---- gallons	2,000	(1)	1,000	(1)
Peat ---- short tons	(4)	(4)	(4)	(4)
Petroleum ---- barrels	994,000	1,610,000	840,000	750,000
Rubbing stones and whetstones ---- short tons	(1)	(1)	(1)	(1)
Sand and gravel ---- do	9,838,757	4,667,771	10,091,450	4,236,521
Sand-lime brick ---- thousands	(1 2)	(1 2)	(1 2)	(1 2)
Stone ---- short tons	4,541,220	19,285,709	[5] 2,831,910	[5] 10,257,555
Sulphuric acid [6] ---- do	(1 3)	(1 3)		
Miscellaneous [7]		15,986,721		9,539,020
Total value, eliminating duplications		79,226,808		50,852,088

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of sandstone, value for which is included under "Miscellaneous."
[6] From zinc smelting.
[7] Includes minerals indicated by "1" and "5" above.

Mineral production of Iowa in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel ---- short tons	(1 2)	(1 2)	(1 2)	(1 2)
Cement ---- barrels	7,035,252	$10,107,584	5,790,087	$5,453,320
Clay products		[3] 4,671,487		[3] 2,276,182
Clay, raw ---- short tons	6,219	[2] 41,816	1,271	[2] 13,322
Coal ---- do	3,892,571	10,385,000	3,388,355	8,575,000
Ferro-alloys ---- long tons	(1 2)	(1 2)	(1 2)	(1 2)
Gypsum ---- short tons	481,047	3,741,319	321,627	2,588,126
Iron, pig ---- long tons			(1 2)	(1 2)
Lime ---- short tons			(1)	(1)
Mineral waters ---- gallons sold	(4)	(4)	(4)	(4)
Natural gas ---- M cubic feet	(1)	(1)		
Sand and gravel ---- short tons	4,521,971	2,599,107	3,403,396	1,511,278
Stone ---- do	[5] 1,813,860	[5] 1,850,832	1,271,310	1,208,755
Miscellaneous [6]		1,156,113		906,621
Total value, eliminating duplications		33,357,958		21,614,611

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Kansas in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement ... barrels	[1] 5, 633, 098	[1] $8, 254, 416	[1] 4, 478, 823	[1] $4, 112, 809
Chats ... short tons	30, 000	7, 500	50, 000	10, 000
Clay products		[2] 2, 315, 005		[2] 1, 268, 896
Coal ... short tons	2, 429, 929	5, 231, 000	1, 986, 870	3, 771, 000
Gypsum ... do	(3)	(3)	(3)	(3)
Lead ... do	12, 910	1, 291, 000	7, 082	524, 068
Mineral paints, zinc and lead pigments ... do	(3 4)	(3 4)	(3 4)	(3 4)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	37, 630, 000	12, 459, 000	38, 742, 000	11, 498, 000
Natural gasoline ... gallons	35, 106, 000	1, 570, 000	32, 690, 000	935, 000
Ores (crude), etc.:				
Lead ... short tons	5, 000	(6)	8, 000	(6)
Lead-zinc ... do	2, 714, 300	(6)	1, 288, 200	(6)
Zinc ... do	798, 000	(6)	617, 000	(6)
Petroleum ... barrels	41, 638, 000	54, 880, 000	37, 018, 000	25, 500, 000
Pumice ... short tons	38, 024	134, 896	47, 783	152, 520
Salt ... do	759, 800	3, 148, 728	691, 160	3, 003, 756
Sand and gravel ... do	3, 232, 858	1, 649, 476	2, 893, 249	1, 333, 175
Stone ... do	[7] 1, 248, 670	[7] 1, 245, 088	[7] 1, 099, 400	[7] 1, 035. 663
Zinc ... do	74, 304	7, 133, 184	39, 051	2, 967, 876
Miscellaneous [8]		2, 182, 935		1, 891, 372
Total value, eliminating duplications		100, 253, 311		56, 804, 312

[1] Exclusive of natural cement, value for which is included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value included under "Miscellaneous."
[4] Value not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of sandstone, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1," "3," and "7" above.

Mineral production of Kentucky in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asphalt (native) ... short tons	305, 024	$2, 374, 834	161, 202	$1, 197, 620
Cement ... barrels	(1)	(1)	(1)	(1)
Clay products		[2] 5, 563, 392		[2] 3, 025, 934
Clay, raw ... short tons	203, 832	[3] 767, 253	125, 330	[3] 620, 450
Coal ... do	51, 208, 995	76, 186, 000	39, 963, 621	50, 745, 000
Coke ... do	(1 3)	(1 3)	(1 3)	(1 3)
Fluorspar ... do	39, 181	763, 370	23, 462	437, 642
Fluorspar, optical			(4)	1, 054
Iron, pig ... long tons	85, 328	(1 3)	128, 194	(1 3)
Lead ... short tons	101	10, 100		
Lime ... do	(1)	(1)	(1)	(1)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	28, 023, 000	9, 691, 000	27, 870, 000	10, 151, 000
Natural gasoline ... gallons	6, 641, 000	385, 000	5, 464, 000	266, 000
Ores (lead and zinc) ... short tons	(6)	(6)		
Petroleum ... barrels	7, 389, 000	11, 080, 000	6, 456, 000	5, 295, 000
Sand and gravel ... short tons	2, 029, 456	1, 553, 812	1, 164, 748	849, 004
Stone ... do	2, 628, 670	2, 635, 369	2, 214, 000	1, 955, 879
Miscellaneous [7]		4, 557, 985		4, 322, 445
Total value, eliminating duplications		111, 691, 254		74, 868, 106

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] Weight not reported.
[5] No canvass.
[6] Figures not available.
[7] Includes minerals indicated by "1" above

Mineral production of Louisiana in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[2] $375,750		[2] $262,326
Mineral waters gallons sold	(3)	(3)	(3)	(3)
Natural gas M cubic feet	278,341,000	35,895,000	224,155,000	37,595,500
Natural gasoline gallons	73,693,000	3,725,000	58,034,000	1,731,000
Petroleum barrels	23,272,000	26,110,000	21,804,000	14,220,000
Salt short tons	535,250	2,164,365	529,280	1,962,690
Sand and gravel do	3,318,965	2,225,211	5,011,756	3,267,191
Sand-lime brick thousands	(1 2)	(1 2)	(1 2)	(1 2)
Stone short tons	(1)	(1)	(1)	(1)
Miscellaneous [4]		1,433,712		2,654,095
Total value, eliminating duplications		71,929,038		61,692,802

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[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] No canvass.
[4] Includes minerals indicated by "1" above.

Mineral production of Maine in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[2] $459,406		[2] $342,096
Clay, raw short tons	175	[3] 1,785	(1 3)	(1 3)
Feldspar (crude) long tons	22,738	161,631	10,220	65,417
Gems and precious stones		(4)		(4)
Lime short tons	66,775	542,115	28,157	250,028
Mica:				
Scrap do	(1)	(1)	102	1,740
Sheet pounds	(1)	(1)		
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Peat short tons	(4)	(4)	(4)	(4)
Sand and gravel do	5,215,342	806,545	4,094,781	454,967
Silica (quartz) do	(1)	(1)		
Slate		506,322		257,619
Stone short tons	318,620	2,252,097	300,100	2,422,766
Miscellaneous [5]		1,499,412		1,096,409
Total value, eliminating duplications		6,227,528		4,889,282

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[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of Maryland in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asbestos...short tons	(1)	(1)	(1)	(1)
Cement...barrels	(1)	(1)	(1)	(1)
Clay products...	...	[2] $3,513,008	...	[2] $2,587,535
Clay, raw...short tons	47,563	[3] 95,568	25,888	[3] 90,587
Coal...do	2,270,593	3,690,000	2,005,773	2,907,000
Coke...do	1,169,016	(1 3)	817,995	(1 3)
Iron, pig...long tons	981,466	(1 3)	677,076	(1 3)
Lime...short tons	53,090	398,841	36,445	268,148
Mineral waters...gallons sold	(4)	(4)	(4)	(4)
Potassium salts...short tons	(1)	(1)	(1)	(1)
Sand and gravel...do	2,678,914	2,330,324	2,017,788	1,701,037
Silica (quartz)...do	1,584	4,123	444	4,928
Slate...	...	(1)	...	(1)
Stone...short tons	[5] 1,215,730	[5] 2,028,021	[5] 1,098,350	[5] 1,484,265
Talc...do	(1)	(1)	(1)	(1)
Miscellaneous [6]...	...	24,785,653	...	16,620,014
Total value, eliminating duplications...	...	14,989,695	...	11,330,323

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of marble, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Massachusetts in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel...short tons	(1 2)	(1 2)	(1 2)	(1 2)
Clay products...	...	[3] $1,718,790	...	[3] $1,763,114
Clay, raw...short tons	9,109	[2] 12,911	1,383	[2] 9,355
Coke...do	862,663	[2] 6,697,235	1,150,270	[2] 9,061,415
Fuller's earth...do	(1)	(1)	(1)	(1)
Iron, pig...long tons	(1 2)	(1 2)	(1 2)	(1 2)
Lime...short tons	107,502	1,072,008	123,607	1,108,036
Mineral waters...gallons sold	(4)	(4)	(4)	(4)
Sand and gravel...short tons	5,226,669	2,790,436	5,040,787	2,622,755
Sand-lime brick...thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silica (quartz)...short tons	765	5,500	...	...
Stone...do	3,008,360	6,865,541	2,401,250	5,480,707
Miscellaneous [5]...	...	2,459,968	...	2,050,667
Total value, eliminating duplications...	...	12,722,974	...	11,170,497

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of Michigan in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel short tons	(1 2)	(1 2)		
Bromine pounds	(1)	(1)	(1)	(1)
Calcium chloride short tons	(1)	(1)	(1)	(1)
Cement barrels	10,817,994	$14,897,439	7,168,720	$6,984,725
Clay products		[3] 4,891,647		[3] 3,417,585
Clay, raw short tons	760	[2] 2,778	185	[2] 1,291
Coal do	661,113	2,323,000	359,403	1,094,000
Coke do	2,603,815	[2] 14,222,856	2,436,630	[2] 11,632,284
Copper pounds	169,381,413	22,019,584	118,059,491	10,743,414
Gems and precious stones		(4)		(4)
Graphite, amorphous short tons	(1)	(1)	(1)	(1)
Grindstones do	(1)	(1)	(1)	(1)
Gypsum do	519,225	3,755,631	383,123	3,537,886
Iron ore:				
Sold to furnaces long tons	11,154,773	31,515,996	5,555,376	15,986,273
Sold for paint do	1,648	(1)	192	(1)
Iron, pig do	711,224	[2] 12,859,820	519,643	[2] 8,964,439
Lime short tons	80,241	630,288	46,716	334,015
Magnesium pounds	559,631	268,864	580,463	199,633
Magnesium chloride (natural) do	(1)	(1)	(1)	(1)
Magnesium sulphate (natural) do	(1)	(1)	(1)	(1)
Manganiferous ore long tons			2,217	(1)
Marl, calcareous short tons			(1)	(1)
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Natural gas M cubic feet	2,075,000	625,000	472,000	111,000
Ore (copper) short tons	6,659,036	(5)	3,570,748	(5)
Peat do	(4)	(4)	(4)	(4)
Petroleum barrels	3,911,000	5,160,000	3,789,000	2,840,000
Salt short tons	2,558,290	7,884,072	2,053,980	5,760,001
Sand and gravel do	11,389,119	5,161,176	8,164,571	3,361,729
Sand-lime brick thousands	[3] 45,391	[3] 551,187	[3] 28,819	[3] 222,223
Silver troy ounces	7,820	3,011	1,437	417
Stone short tons	[6] 10,561,120	[6] 6,816,972	6,203,220	4,055,019
Miscellaneous [7]		4,908,063		4,137,988
Total value, eliminating duplications		111,405,530		62,785,908

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Minnesota in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[2] $1,647,007		[2] $1,137,737
Clay, raw short tons	12,228	[3] 27,602	12,327	[3] 28,131
Coke do	641,205	[3] 5,508,979	440,489	[3] 3,521,295
Feldspar (crude) long tons			(1)	(1)
Flint lining for tube mills short tons	(1)	(1)	(1)	(1)
Gems and precious stones		(4)		(4)
Iron ore long tons	34,165,777	90,835,451	17,063,591	46,020,269
Iron, pig do	266,622	(1 3)	17,878	(1 3)
Lime short tons	(1)	(1)	(1)	(1)
Manganiferous ore long tons	698,244	1,812,171	243,919	733,788
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Pebbles for grinding short tons	(1)	(1)	(1)	(1)
Sand and gravel do	4,590,790	2,274,293	4,496,777	2,404,718
Sand-lime brick thousands	(1 2)	(1 2)	[2] 11,452	[2] 94,052
Stone short tons	562,130	3,923,372	[5] 349,390	[5] 3,036,920
Miscellaneous [6]		8,115,789		2,148,430
Total value, eliminating duplications		103,931,377		55,275,230

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of basalt, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Mississippi in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Clay products		[1] $613,350		[1] $329,440
Clay, raw ... short tons			(2 3)	(2 3)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	179,000	86,000	6,048,000	1,458,000
Sand and gravel ... short tons	2,001,272	1,050,579	1,218,372	592,064
Stone ... do	22,190	24,692	(2)	(2)
Miscellaneous [5]				9,067
Total value, eliminating duplications		1,774,621		2,387,771

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[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] Value not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "2" above.

Mineral production of Missouri in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Barite ... short tons	132,640	$938,812	93,417	$539,152
Briquets, fuel ... do	(1 2)	(1 2)	(1 2)	(1 2)
Cement ... barrels	8,030,528	11,470,751	5,103,287	5,052,840
Chats ... short tons	1,433,284	355,821	1,343,463	335,865
Clay products		[3] 12,517,707		[3] 6,442,039
Clay, raw ... short tons	412,827	[2] 1,275,787	219,181	[2] 738,607
Coal ... do	3,853,150	8,967,000	3,620,497	7,248,000
Coke ... do	(1 2)	(1 2)	(1 2)	(1 2)
Copper ... pounds	176,600	22,958		
Iron ore ... long tons	132,749	508,354	112,055	337,144
Lead ... short tons	199,632	19,963,200	160,121	11,848,954
Lime ... do	265,771	1,861,105	224,416	1,481,240
Mineral paints, zinc and lead pigments ... do	(1 2)	(1 2)	7,360	(1 2)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	1,064,000	326,000	1,534,000	685,000
Ores (crude), etc.:				
Lead ... short tons	6,694,800	(5)	5,140,600	(5)
Lead-zinc ... do	30,900	(5)	30,800	(5)
Zinc ... do	284,400	(5)	69,000	(5)
Sand and gravel ... do	5,956,766	4,776,078	4,807,626	2,646,756
Sand and sandstone (finely ground) ... do	2,222	14,553	(1)	(1)
Sand-lime brick ... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silver ... troy ounces	170,210	65,531	40,000	11,600
Stone ... short tons	[6] 3,910,060	[6] 6,007,531	3,526,230	4,767,396
Tripoli ... do	(1)	(1)	(1)	(1)
Zinc ... do	10,811	1,037,856	3,205	243,580
Miscellaneous [7]		3,115,439		2,546,040
Total value, eliminating duplications		69,074,500		41,805,772

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[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Montana in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Arsenious oxide .... short tons..	12,680	$732,886	8,019	$463,497
Cement .... barrels..	(1)	(1)	(1)	(1)
Clay products	....	[2] 295,513	....	[2] 135,803
Clay, raw .... short tons..	7,234	[3] 11,053	4,274	[3] 6,904
Coal .... do....	3,022,004	6,043,000	2,378,052	4,299,000
Copper .... pounds..	196,187,523	25,504,378	184,555,735	16,794,572
Gems and precious stones	....	(4)	....	(4)
Gold .... troy ounces..	43,489	899,001	40,112	829,192
Gypsum .... short tons..	(1)	(1)	(1)	(1)
Lead .... do....	10,653	1,065,302	4,430	327,827
Lime .... do....	(1)	(1)	2,028	26,666
Manganese ore .... long tons..	35,605	899,065	25,812	492,282
Manganiferous ore .... do....	11,875	(1)	14,311	(1)
Marl, calcareous .... short tons..	(1)	(1)	....	....
Micaceous minerals (vermiculite) .... do....	(1)	(1)	(1)	(1)
Mineral waters .... gallons sold..	(4)	(4)	(4)	(4)
Natural gas .... M cubic feet..	10,060,000	2,990,000	10,949,000	3,299,000
Ores (crude), etc.:				
Copper .... short tons..	2,238,997	(5)	1,878,757	(5)
Copper-lead .... do....	330	(5)	79	(5)
Dry and siliceous (gold and silver) .... do....	95,548	(5)	87,867	(5)
Lead .... do....	23,642	(5)	3,031	(5)
Lead-zinc .... do....	168,864	(5)	50,949	(5)
Zinc .... do....	159,288	(5)	65,000	(5)
Petroleum .... barrels..	3,349,000	5,420,000	2,830,000	2,730,000
Phosphate rock .... long tons..	6,005	27,457	67,893	301,511
Sand and gravel .... short tons..	1,523,516	471,555	322.201	178,739
Silver .... troy ounces..	7,052,889	2,715,362	3,829,837	1,110,653
Stone .... short tons..	[6] 592,810	[6] 284,658	[6] 86,870	[6] 117,883
Sulphuric acid [7] .... do....	(1 3)	(1 3)	(1 3)	(1 3)
Tungsten ore (60 per cent concentrates) .... do....	31	(1)	....	....
Zinc .... do....	26,421	2,536,373	6,747	512,809
Miscellaneous [8]	....	1,545,108	....	988,696
Total value, eliminating duplications	....	50,995,123	....	32,359,904

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of unclassified stone in 1930 and of sandstone in 1931, value for which is included under "Miscellaneous."
[7] From copper smelting.
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of Nebraska in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement .... barrels..	(1)	(1)	(1)	(1)
Clay products	....	[2] $496,714	....	[2] $386,951
Clay, raw .... short tons..	13,144	[3] 14,526	2,641	[3] 4,034
Mineral waters .... gallons sold..	(4)	(4)	(4)	(4)
Pumice .... short tons..	(1)	(1)	(1)	(1)
Sand and gravel .... do....	3,443,715	1,731,230	3,103,917	1,425,956
Stone .... do....	103,120	188,674	74,030	117,611
Miscellaneous [5]	....	2,545,394	....	1,692,908
Total value, eliminating duplications	....	4,962,012	....	3,623,426

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of Nevada in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Barite..........short tons..	2,647	$19,457	1,400	$9,600
Clay products..........	------	(1 2)	------	(1 2)
Clay, raw..........short tons..	1,534	[3] 8,294	2,023	[3] 11,545
Coal..........do....	------	------	(1)	(1)
Copper..........pounds..	109,203,512	14,196,457	72,634,497	6,609,739
Diatomite..........short tons..	779	20,747	347	10,490
Feldspar (crude)..........long tons..	------	------	(1)	(1)
Fluorspar..........short tons..	974	(1)	395	(1)
Fuller's earth..........do....	(1)	(1)	(1)	(1)
Gems and precious stones..........	------	(4)	------	(4)
Gold..........troy ounces..	149,064	3,081,436	142,294	2,941,473
Graphite, amorphous..........short tons..	(1)	(1)	(1)	(1)
Gypsum..........do....	165,279	976,650	131,079	792,486
Lead..........do....	11,529	1,152,919	7,930	586,843
Lime..........do....	(1)	(1)	(1)	(1)
Manganese ore..........long tons..	1,489	17,617	------	------
Manganiferous ore..........do....	3,363	(1)	------	------
Marl, calcareous..........short tons..	(1)	(1)	1,007	4,635
Mercury..........flasks (76 pounds)..	3,282	377,460	2,217	193,657
Mineral waters..........gallons sold..	(4)	(4)	(4)	(4)
Ores (crude), etc.:				
Copper..........short tons..	4,015,426	(5)	2,936,899	(5)
Copper-lead..........do....	30,171	(5)	3,824	(5)
Dry and siliceous (gold and silver)....do....	543,049	(5)	483,157	(5)
Lead..........do....	10,413	(5)	22,297	(5)
Lead-zinc..........do....	157,961	(5)	119,220	(5)
Zinc..........do....	158	(5)	75	(5)
Potassium salts..........do....	(1)	(1)	(1)	(1)
Salt..........do....	(1)	(1)	(1)	(1)
Sand and gravel..........do....	489,726	184,691	2,186,249	1,029,804
Silver..........troy ounces..	4,219,832	1,624,635	2,562,071	743,001
Sodium sulphate from natural souces ....short tons..	(1)	(1)	(1)	(1)
Stone..........do....	30,120	46,850	58,600	64,048
Sulphur..........long tons..	------	------	(1)	(1)
Talc..........short tons..	50	600	------	------
Tungsten ore (60 per cent concentrates)....do....	(1)	(1)	(1)	(1)
Zinc..........do....	14,584	1,400,070	10,431	792,731
Miscellaneous [6]..........	------	975,786	------	1,185,278
Total value, eliminating duplications.....	------	24,075,375	------	14,963,785

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[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

Mineral production of New Hampshire in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Clay products		[1] $928,138		[1] $349,508
Feldspar (crude) long tons	16,517	132,342	12,573	102,140
Garnet, abrasive short tons	(2)	(2)	(2)	(2)
Mica:				
Scrap do	449	8,743	295	5,465
Sheet pounds	673,064	53,304	441,164	36,368
Millstones		2,325		
Mineral waters gallons sold	(3)	(3)	(3)	(3)
Sand and gravel short tons	939,767	556,808	1,221,259	1,031,494
Silica (quartz) do	132	396	(2)	(2)
Stone do	150,800	1,540,591	188,310	1,217,020
Miscellaneous		114,522		54,137
Total value, eliminating duplications		3,337,169		2,796,132

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] No canvass.

Mineral production of New Jersey in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel short tons	(1 2)	(1 2)	(1 2)	(1 2)
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[3] $29,098,326		[3] $19,901,266
Clay, raw short tons	170,286	[2] 713,136	135,537	[2] 515,821
Coke do	918,814	(1 2)	930,912	(1 2)
Ferro-alloys long tons	(1 2)	(1 2)	(1 2)	(1 2)
Graphite, artificial pounds	(1 2)	(1 2)	(1 2)	(1 2)
Iron ore long tons	391,528	1,632,827	239,722	984,021
Iron, pig do	405	(1 2)		
Lime short tons	(1)	(1)	(1)	(1)
Manganiferous residuum long tons	113,060	(1)	96,990	(1)
Marl, greensand short tons	12,761	221,211	8,252	196,327
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Ore (zinc) short tons	690,348	(5)	640,560	(5)
Peat do	(4)	(4)	(4)	(4)
Sand and gravel do	5,969,479	5,009,866	4,329,994	3,433,176
Sand and sandstone (finely ground) do	(1)	(1)	(1)	(1)
Sand-lime brick thousands	(1 3)	(1 3)	(1 3)	(1 3)
Slate		(1)		
Stone short tons	2,702,420	3,907,281	[6] 2,381,700	[6] 2,994,241
Talc do	(1)	(1)	(1)	(1)
Zinc do	97,626	(1)	94,285	(1)
Miscellaneous [7]		24,141,743		20,604,631
Total value, eliminating duplications		57,206,357		41,632,683

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metal.
[6] Exclusive of granite, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of New Mexico in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asphalt (native) ..... short tons			(1)	(1)
Clay products		[2] $181,117		[2] $123,008
Clay, raw ..... short tons	6,400	[3] 10,923	1,444	[3] 6,444
Coal ..... do	1,969,433	6,017,000	1,552,822	4,597,000
Columbite ..... pounds	1,000	(1)	(1)	(1)
Copper ..... do	65,150,000	8,469,500	61,503,100	5,596,782
Fluorspar ..... short tons	2,312	(1)	1,026	(1)
Fluorspar, optical			(4)	176
Gems and precious stones		(5)		(5)
Gold ..... troy ounces	32,370	669,156	31,161	644,160
Iron ore ..... long tons	173,432	(1)	168,075	(1)
Lead ..... short tons	10,378	1,037,845	11,269	833,869
Lime ..... do	2,369	21,446	(1)	(1)
Lithium minerals ..... do	(1)	(1)		
Manganese ore ..... long tons	2,574	34,884	1,072	(1)
Manganiferous ore ..... do	14,427	41,116		
Mica:				
Scrap ..... short tons	768	12,004	(1)	(1)
Sheet ..... pounds	(1)	(1)	(1)	(1)
Mineral waters ..... gallons sold	(5)	(5)	(5)	(5)
Molybdenum ..... pounds	(1)	(1)	(1)	(1)
Natural gas ..... M cubic feet	9,497,000	1,273,000	19,354,000	2,401,000
Natural gasoline ..... gallons	3,663,000	169,000	17,775,000	419,000
Ores (crude), etc.:				
Copper ..... short tons	2,636,107	(6)	2,642,654	(6)
Copper-lead ..... do			3,347	(6)
Dry and siliceous (gold and silver) ..... do	28,933	(6)	97,502	(6)
Lead ..... do	5,726	(6)	1,982	(6)
Lead-zinc ..... do	211,562	(6)	225,581	(6)
Zinc ..... do	89,113	(6)	32,875	(6)
Petroleum ..... barrels	10,189,000	9,180,000	15,227,000	6,490,000
Potassium salts ..... short tons			(1)	(1)
Salt ..... do	(1)	(1)	(1)	(1)
Sand and gravel ..... do	314,667	282,360	339,640	275,086
Silver ..... troy ounces	1,107,335	426,324	1,041,859	302,139
Stone ..... short tons	213,340	161,944	375,650	537,740
Uranium ore ..... do			(1)	(1)
Zinc ..... do	32,765	3,145,392	27,866	2,117,816
Miscellaneous [7]		728,175		1,011,936
Total value, eliminating duplications		31,850,263		25,349,712

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[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] Weight not reported.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Includes minerals indicated by "1" above.

Mineral production of New York in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Aluminum ... pounds	(1 2)	(1 2)	(1 2)	(1 2)
Cement ... barrels	[3] 10,256,086	[3] $15,380,703	[3] 9,833,048	[3] $10,638,666
Clay products		[4] 14,837,430		[4] 11,572,398
Clay, raw ... short tons	5,191	[2] 33,458	4,399	[2] 27,777
Coke ... do	3,849,563	[2] 24,657,090	3,578,311	[2] 22,115,932
Diatomite ... do	208	14,767	294	20,032
Emery ... do	555	5,996	512	5,557
Feldspar (crude) ... long tons	5,556	37,790	6,160	29,959
Ferro-alloys ... do	143,269	[2] 11,526,887	83,124	[2] 7,652,809
Garnet, abrasive ... short tons	(1)	(1)	(1)	(1)
Graphite, artificial ... pounds	(1 2)	(1 2)	(1 2)	(1 2)
Gypsum ... short tons	912,070	7,059,108	744,613	6,111,853
Iron ore:				
Sold to furnaces ... long tons	755,074	3,663,155	259,184	1,067,489
Sold for paint ... do	(1)	(1)	(1)	(1)
Iron, pig ... do	1,638,323	[2] 29,160,894	1,014,320	[2] 15,568,275
Lead ... short tons	(1)	(1)	(1)	(1)
Lime ... do	83,078	702,475	49,574	412,351
Millstones		6,577		2,030
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	9,624,000	6,433,000	7,868,000	5,363,000
Natural gasoline ... gallons	208,000	19,000	132,000	9,000
Ores (crude), etc.:				
Lead-zinc ... short tons	131,245	(6)	176,434	(6)
Zinc ... do	139,356	(6)	93,148	(6)
Peat ... do	(5)	(5)	(5)	(5)
Petroleum ... barrels	3,647,000	9,850,000	3,363,000	6,800,000
Pyrites ... long tons	15,474	(1)	26,604	(1)
Salt ... short tons	2,009,280	5,837,103	1,788,940	5,293,470
Sand and gravel ... do	20,865,866	12,710,172	17,155,174	10,612,014
Sand-lime brick ... thousands	(1 4)	(1 4)	(1 4)	(1 4)
Silica (quartz) ... short tons	(1)	(1)	(1)	(1)
Slate		438,619		325,476
Stone ... short tons	12,915,190	18,141,668	12,528,020	15,598,054
Talc ... do	93,216	1,192,604	84,977	1,059,790
Zinc ... do	22,471	2,157,216	24,100	1,831,600
Miscellaneous [7]		30,725,205		22,189,728
Total value, eliminating duplications		99,622,368		78,007,467

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[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Exclusive of natural cement, value for which is included under "Miscellaneous."
[4] Figures obtained through cooperation with Bureau of the Census.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Includes minerals indicated by "1" and "3" above.

Mineral production of North Carolina in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Aluminum..........pounds..	(1 2)	(1 2)	(1 2)	(1 2)
Clay products..........	....	[3] $1,714,304	....	[3] $1,154,732
Clay, raw..........short tons..	24,759	[2] 391,571	12,287	[2] 195,700
Coal..........do....	28,500	100,000	2,363	9,000
Copper..........pounds..	(1)	(1)	(1)	(1)
Feldspar (crude)..........long tons..	103,163	593,552	86,429	505,525
Gems and precious stones..........	....	(4)	....	(4)
Gold..........troy ounces..	705	14,582	368	7,598
Lime..........short tons..	(1)	(1)	(1)	(1)
Manganese ore..........long tons..	60	(1)	....	....
Marl, calcareous..........short tons..	(1)	(1)	1,000	2,250
Mica:				
Scrap..........do....	4,744	75,400	5,312	79,601
Sheet..........pounds..	749,074	112,451	389,426	51,657
Micaceous minerals (muscovite schist)..........short tons..	(1)	(1)	(1)	(1)
Millstones..........	....	4,250	....	2,800
Mineral waters..........gallons sold..	(4)	(4)	(4)	(4)
Ores (crude):				
Copper..........short tons..	97,445	(5)	63,650	(5)
Dry and siliceous (gold and silver)...do....	700	(5)	150	(5)
Sand and gravel..........do....	800,222	437,555	414,282	238,053
Silica (quartz)..........do....	2,981	23,838	1,807	11,460
Silver..........troy ounces..	30,054	11,571	20,333	5,897
Stone..........short tons..	1,099,960	2,456,887	1,140,900	2,485,640
Talc..........do....	(1)	(1)	15,283	170,250
Tin (metallic equivalent)..........do....	(1)	(1)	....	....
Miscellaneous [6]..........	....	8,685,060	....	6,351,727
Total value, eliminating duplications......	....	7,462,450	....	5,554,190

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

Mineral production of North Dakota in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel .... short tons	(1 2)	(1 2)	(1 2)	(1 2)
Clay products	....	[3] $160,838	....	[3] $76,085
Clay, raw .... short tons	359	[2] 557	2	[2] 33
Coal .... do	1,700,157	2,768,000	1,519,307	2,155,000
Mineral waters .... gallons sold	(4)	(4)	(4)	(4)
Natural gas .... M cubic feet	(1)	(1)	....	....
Sand and gravel .... short tons	473,184	127,505	89,022	40,369
Miscellaneous	....	63,231	....	23,000
Total value, eliminating duplications	....	3,056,493	....	2,271,454

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.

Mineral production of Ohio in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Bromine .... pounds	(1)	(1)	(1)	(1)
Calcium chloride .... short tons	(1)	(1)	(1)	(1)
Cement .... barrels	[2] 8,185,077	[2] $11,956,038	[2] 6,211,789	[2] $6,146,302
Clay products	....	[3] 61,449,555	....	[3] 39,419,590
Clay, raw .... short tons	419,217	[4] 811,028	268,835	[4] 534,811
Coal .... do	22,551,978	31,643,000	20,410,995	25,371,000
Coke .... do	6,163,324	[4] 26,706,788	3,932,939	[4] 17,588,581
Ferro-alloys .... long tons	78,746	[4] 2,365,006	59,074	[4] 2,032,617
Grindstones and pulpstones .... short tons	12,114	358,875	5,198	171,785
Gypsum .... do	255,337	3,094,495	(1)	(1)
Iron, pig .... long tons	6,541,212	[4] 111,529,209	4,290,669	[4] 69,001,692
Lime .... short tons	736,305	5,711,855	656,441	4,007,004
Marl, calcareous .... do	(1)	(1)	(1)	(1)
Mineral paints, zinc and lead pigments .... do	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters .... gallons sold	(5)	(5)	(5)	(5)
Natural gas .... M cubic feet	63,394,000	36,491,000	56,326,000	32,061,000
Natural gasoline .... gallons	8,937,000	605,000	5,199,000	271,000
Petroleum .... barrels	6,486,000	11,960,000	5,327,000	5,610,000
Rubbing stones, scythestones, and whetstones .... short tons	229	29,986	154	20,377
Salt .... do	1,311,440	3,015,206	1,398,000	2,526,952
Sand and gravel .... do	12,679,854	8,173,741	8,387,377	5,216,816
Sand and sandstone (finely ground) .... do	(1)	(1)	(1)	(1)
Sand-lime brick .... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silica (quartz) .... short tons	....	....	(1)	(1)
Stone .... do	13,008,030	12,329,536	9,416,610	8,093,741
Sulphuric acid [6] .... do	(1 4)	(1 4)	(1 4)	(1 4)
Miscellaneous [7]	....	3,599,933	....	5,083,532
Total value, eliminating duplications	....	186,971,555	....	130,927,783

[1] Value included under "Miscellaneous."
[2] Exclusive of natural cement, value for which is included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Value not included in total value for State.
[5] No canvass.
[6] From zinc smelting.
[7] Includes minerals indicated by "1" and "2" above.

Mineral production of Oklahoma in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asphalt (native)......short tons..	(1)	(1)	(1)	(1)
Briquets, fuel......do....	(1 2)	(1 2)	(1 2)	(1 2)
Calcium chloride......do....			(1)	(1)
Cement......barrels..	(1)	(1)	(1)	(1)
Chats......short tons..	330,000	$82,500	146,000	$21,900
Clay products......		[3] 941,365		(1 3)
Clay, raw......short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Coal......do....	2,793,954	7,768,000	1,908,394	4,614,000
Gypsum......do....	(1)	(1)	(1)	(1)
Lead......do....	23,052	2,305,200	13,210	977,540
Lime......do....	(1)	(1)		
Mineral waters......gallons sold..	(4)	(4)	(4)	(4)
Natural gas......M cubic feet..	348,116,000	47,632,000	263,685,000	32,593,000
Natural gasoline......gallons..	591,194,000	29,148,000	454,886,000	12,619,000
Ores (crude), etc.:				
Lead-zinc......short tons..	4,125,400	(5)	1,620,800	(5)
Zinc......do....	3,088,200	(5)	2,208,100	(5)
Petroleum......barrels..	216,486,000	279,250,000	180,574,000	119,200,000
Pumice......short tons..			1,000	8,000
Salt......do....	(1)	(1)	(1)	(1)
Sand and gravel......do....	2,553,070	1,446,137	937,746	529,851
Stone......do....	[6] 1,958,120	[6] 1,631,477	1,731,680	1,410,782
Sulphuric acid [7]......do....	(1 2)	(1 2)	(1 2)	(1 2)
Tripoli......do....	(1)	(1)	(1)	(1)
Zinc......do....	136,153	13,070,688	78,132	5,938,032
Miscellaneous [8]......		7,363,290		4,407,955
Total value, eliminating duplications......		390,170,991		181,904,857

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[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of Oregon in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel......short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Cement......barrels..	(1)	(1)	(1)	(1)
Clay products......		[3] $393,955		[3] $268,821
Clay, raw......short tons..	41	[2] 154	51	[2] 170
Coal......do....	(1)	(1)	(1)	(1)
Copper......pounds..	176,300	22,919	1,700	155
Diatomite......short tons..	(1)	(1)	(1)	(1)
Gems and precious stones......		(4)		(4)
Gold......troy ounces..	14,401	297,702	15,350	317,315
Lead......short tons..	5	456	2	129
Lime......do....	1,741	25,196	(1)	(1)
Mercury......flasks (76 pounds)..	2,919	335,711	5,011	437,716
Mineral waters......gallons sold..	(4)	(4)	(4)	(4)
Ores (crude), etc.:				
Copper......short tons..	1,033	(5)		
Dry and siliceous (gold and silver)....do....	7,918	(5)	7,092	(5)
Lead-zinc......do....	43	(5)		
Platinum and allied metals......troy ounces..	8	487	15	700
Sand and gravel......short tons..	2,824,519	1,644,243	1,861,049	1,014,092
Silver......troy ounces..	9,000	3,465	7,254	2,104
Stone......short tons..	1,685,740	1,708,956	1,641,090	1,515,556
Zinc......do....	6	601		
Miscellaneous [6]......		2,453,926		1,996,489
Total value, eliminating duplications......		6,169,898		5,045,307

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[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

Mineral production of Pennsylvania in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel……short tons	133,922	[1] $833,104	93,177	[1] $550,160
Cement……barrels	[2] 37,968,647	[2] 52,712,176	[2] 28,412,975	[2] 30,952,302
Clay products……		[3] 38,336,710		[3] 23,453,227
Clay, raw……short tons	801,553	[1] 1,965,186	458,820	[1] 1,205,609
Coal:				
Anthracite……do	69,384,837	354,574,191	59,645,652	296,354,586
Bituminous……do	124,462,787	213,584,000	97,658,698	155,060,000
Coke……do	14,540,579	[1] 54,098,236	8,380,249	[1] 32,458,184
Copper [4]……pounds	2,859,675	371,758	(5)	(5)
Feldspar (crude)……long tons	(5)	(5)	(5)	(5)
Ferro-alloys……do	340,475	[1] 29,627,740	173,565	[1] 15,067,302
Gems and precious stones……		(6)		(6)
Gold [4]……troy ounces	630	13,023	252	5,200
Iron ore:				
Sold to furnaces……long tons	894,039	1,850,661	436,920	913,163
Sold for paint……do	(5)	(5)	818	(5)
Iron, pig……do	9,734,591	[1] 176,521,843	5,099,016	[1] 86,877,965
Lime……short tons	633,520	4,661,670	497,258	3,378,088
Marl, calcareous……do			(5)	(5)
Mineral paints, zinc and lead pigments……do	(1 5)	(1 5)	(1 5)	(1 5)
Mineral waters……gallons sold	(6)	(6)	(6)	(6)
Natural gas……M cubic feet	88,706,000	44,521,000	74,797,000	37,827,000
Natural gasoline……gallons	16,713,000	1,229,000	14,339,000	706,000
Peat……short tons	(6)	(6)	(6)	(6)
Petroleum……barrels	12,803,000	33,410,000	11,892,000	23,550,000
Sand and gravel……short tons	11,012,512	11,107,825	8,238,926	6,977,246
Sand and sandstone (finely ground)……do	(5)	(5)	(5)	(5)
Sand-lime brick……thousands	(3 5)	(3 5)	(3 5)	(3 5)
Silver [4]……troy ounces	5,762	2,218	2,600	754
Slate……		3,634,258		2,791,752
Stone……short tons	15,137,560	17,822,706	[7] 11,123,680	[7] 11,926,265
Sulphuric acid (60° Baumé) [8]……do	141,506	[1] 1,362,703	(1 5)	(1 5)
Talc……do	(5)	(5)	(5)	(5)
Tripoli (rottenstone)……do	(5)	(5)	(5)	(5)
Miscellaneous [9]……		8,963,050		8,337,597
Total value, eliminating duplications……		778,523,421		594,642,786

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[1] Value not included in total value for State.
[2] Exclusive of natural cement, value for which is included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Copper, gold, and silver were recovered from pyritiferous magnetite. The quantity of such ore was 1,001,324 short tons in 1930 and 488,788 short tons in 1931; it is included in the figures shown for iron ore.
[5] Value included under "Miscellaneous."
[6] No canvass.
[7] Exclusive of marble, value for which is included under "Miscellaneous."
[8] From zinc smelting.
[9] Includes minerals indicated by "2," "5," and "7" above.

Mineral production of Rhode Island in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Clay products……		(1 2)		(1 2)
Coke……short tons	(1 3)	(1 3)	(1 3)	(1 3)
Graphite, amorphous……do	(1)	(1)		
Lime……do	2,638	$34,986	2,042	$24,846
Mineral waters……gallons sold	(4)	(4)	(4)	(4)
Sand and gravel……short tons	728,390	283,174	522,480	168,103
Stone……do	201,110	757,306	129,580	516,053
Miscellaneous [5]……		1,592,385		1,601,221
Total value, eliminating duplications……		1,209,227		792,911

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[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of South Carolina in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Barite short tons	(1)	(1)		
Clay products		[2] $792,761		[2] $407,855
Clay, raw short tons	92,116	[3] 747,620	80,480	[3] 586,720
Gold troy ounces			23	470
Marl, calcareous short tons	(1)	(1)		
Mica:				
Scrap do	(1)	(1)		
Sheet pounds	(1)	(1)	(1)	(1)
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Sand and gravel short tons	744,378	475,009	582,308	191,782
Silver troy ounces			1	(5)
Stone short tons	1,391,910	2,021,213	1,721,720	2,431,320
Miscellaneous		52,068		32
Total value, eliminating duplications		3,341,051		3,031,459

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] 29 cents.

Mineral production of South Dakota in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement barrels	(1)	(1)	(1)	(1)
Clay products		(1 2)		
Clay, raw short tons	960	[3] $3,840	650	[3] $2,700
Coal do	12,810	31,000	27,485	64,000
Columbite pounds	4,100	(1)	(1)	(1)
Feldspar (crude) long tons	(1)	(1)	11,062	39,013
Gems and precious stones		(4)		(4)
Gold troy ounces	407,221	8,418,008	432,075	8,931,791
Gypsum short tons	(1)	(1)	(1)	(1)
Lime do	(1)	(1)	2,682	29,000
Lithium minerals do	(1)	(1)	(1)	(1)
Mica:				
Scrap do	(1)	(1)	(1)	(1)
Sheet pounds	(1)	(1)	(1)	(1)
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Natural gas M cubic feet	98,000	32,000	12,000	4,000
Ores (crude), etc.:				
Dry and siliceous (gold and silver) short tons	1,365,156	(5)	1,404,153	(5)
Pumice do	80	1,600	600	12,000
Sand and gravel do	2,419,441	931,814	2,369,279	931,137
Sand-lime brick thousands	(1 2)	(1 2)	(1 2)	(1 2)
Silver troy ounces	105,236	40,516	113,562	32,933
Stone short tons	166,020	666,201	222,510	636,841
Tin (metallic equivalent) do	(1)	(1)	(6)	50
Miscellaneous [7]		954,669		657,974
Total value, eliminating duplications		11,075,808		11,338,739

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] 189 pounds.
[7] Includes minerals indicated by "1" above.

Mineral production of Tennessee in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Aluminum ... pounds	(1 2)	(1 2)	(1 2)	(1 2)
Barite ... short tons	17,006	$111,981	10,170	$62,903
Cement ... barrels	3,822,598	5,315,693	3,287,966	3,810,271
Clay products	---	[3] 1,915,224	---	[3] 2,003,132
Clay, raw ... short tons	69,700	[2] 365,659	46,941	[2] 260,793
Coal ... do	5,130,428	8,417,000	4,721,548	6,942,000
Coke ... do	125,912	[2] 523,813	100,513	[2] 409,647
Copper ... pounds	(1)	(1)	(1)	(1)
Ferro-alloys ... long tons	(1 2)	(1 2)	(1 2)	(1 2)
Gold ... troy ounces	696	14,388	403	8,325
Iron ore:				
Sold to furnaces ... long tons	27,384	76,089	8,717	36,156
Sold for paint ... do	(1)	(1)	---	---
Iron, pig ... do	42,197	[2] 828,716	13,094	[2] 293,111
Iron sinter from copper sulphide ore ... do	(1)	(1)	(1)	(1)
Lead ... short tons	(1)	(1)	(1)	(1)
Lime ... do	147,648	855,452	113,268	566,694
Manganese ore ... long tons	508	(1)	70	(1)
Manganiferous ore ... do	113	(1)	---	---
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	24,000	9,000	25,000	9,000
Ores (crude), etc.:				
Copper ... short tons	789,495	(5)	510,838	(5)
Lead-zinc ... do	10,000	(5)	11,700	(5)
Zinc ... do	699,760	(5)	767,800	(5)
Petroleum ... barrels	21,000	26,000	6,000	5,000
Phosphate rock ... long tons	611,045	2,938,525	343,622	1,545,607
Pyrites ... do	(1)	(1)	(1)	(1)
Sand and gravel ... short tons	2,182,958	1,436,034	1,824,415	1,089,178
Silver ... troy ounces	83,640	32,201	41,000	11,890
Stone ... short tons	1,783,530	5,186,653	1,552,890	4,109,842
Sulphuric acid [6] ... do	(1 2)	(1 2)	(1 2)	(1 2)
Tripoli ... do	(1)	(1)	(1)	(1)
Zinc ... do	(1)	(1)	(1)	(1)
Miscellaneous [7]	---	25,774,979	---	18,211,797
Total value, eliminating duplications	---	32,499,380	---	24,461,447

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[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] From copper smelting.
[7] Includes minerals indicated by "1" above.

Mineral production of Texas in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asphalt (native) ... short tons	270,138	$825,460	228,956	$705,437
Briquets, fuel ... do	(1 2)	(1 2)	(1 2)	(1 2)
Cement ... barrels	6,792,346	10,782,444	6,265,016	8,280,913
Clay products		[3] 4,007,858		[3] 2,118,949
Clay, raw ... short tons	14,774	[2] 105,971	21,263	[2] 147,476
Coal ... do	833,872	1,307,000	716,020	1,070,000
Copper ... pounds	143,100	18,603		
Fuller's earth ... short tons	45,503	443,477	35,540	350,809
Gems and precious stones		(4)		(4)
Gold ... troy ounces	176	3,648		
Gypsum ... short tons	359,315	3,521,743	239,391	2,120,208
Lead ... do	198	19,841		
Lime ... do	74,081	639,821	45,553	384,392
Manganese ore ... long tons	247	4,147	155	(1)
Mercury ... flasks (76 pounds)	(1)	(1)	(1)	(1)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	517,880,000	71,873,000	464,580,000	73,704,600
Natural gasoline ... gallons	491,299,000	23,596,000	426,695,000	11,887,000
Ores (crude), etc.:				
Copper ... short tons	734	(5)		
Dry and siliceous (gold and silver) ... do	29,677	(5)		
Lead ... do	736	(5)		
Petroleum ... barrels	290,457,000	288,410,000	332,437,000	170,950,000
Salt ... short tons	(1)	(1)	103,040	468,562
Sand and gravel ... do	8,803,929	5,567,127	6,081,134	3,809,267
Sand-lime brick ... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silver ... troy ounces	389,239	149,857		
Stone ... short tons	[6] 2,807,960	[6] 2,496,136	1,347,100	1,285,558
Sulphur ... long tons	1,989,917	35,800,000	1,376,524	24,760,739
Miscellaneous [7]		951,323		331,968
Total value, eliminating duplications		450,373,151		302,201,046

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[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of basalt, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Utah in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Arsenious oxide.........short tons..	2,297	$132,738	2,344	$135,483
Asphalt (native).........do....	47,635	965,587	(1)	(1)
Cement.........barrels..	(1)	(1)	(1)	(1)
Clay products.........	------------	[2] 732,608	------------	[2] 329,051
Clay, raw.........short tons..	35,092	[3] 385,462	5,599	[3] 10,894
Coal.........do....	4,257,541	10,515,000	3,350,044	7,442,000
Coke.........do....	231,869	(1 3)	(1 3)	(1 3)
Copper.........pounds..	180,526,423	23,468,435	151,236,505	13,762,522
Fuller's earth.........short tons..	------------	------------	(1)	(1)
Gems and precious stones.........	------------	(4)	------------	(4)
Gold.........troy ounces..	208,455	4,309,148	198,740	4,108,323
Gypsum.........short tons..	26,694	185,148	22,178	133,533
Iron ore:				
Sold to furnaces.........long tons..	278,918	(1)	183,668	(1)
Sold for paint.........do....	200	(1)	400	(1)
Iron, pig.........do....	(1 3)	(1 3)	(1 3)	(1 3)
Lead.........short tons..	115,495	11,549,489	79,212	5,861,668
Lime.........do....	27,522	236,607	18,192	172,534
Manganiferous ore.........long tons..	10,972	91,742	1,501	16,601
Natural gas.........M cubic feet..	393,000	123,000	(1)	(1)
Ores (crude), etc.:				
Copper.........short tons..	9,696,962	(5)	8,212,141	(5)
Copper-lead.........do....	52,757	(5)	79	(5)
Dry and siliceous (gold and silver)...do....	223,010	(5)	133,917	(5)
Lead.........do....	237,240	(5)	140,960	(5)
Lead-zinc.........do....	831,872	(5)	467,520	(5)
Petroleum.........barrels..	(1)	(1)	(1)	(1)
Potassium salts.........short tons..	------------	------------	(1)	(1)
Salt.........do....	85,240	188,983	74,010	159,778
Sand and gravel.........do....	1,201,849	613,951	1,453,335	763,902
Silver.........troy ounces..	13,129,421	5,054,827	8,290,966	2,404,380
Stone.........short tons..	633,630	395,174	170,710	201,735
Sulphuric acid [6].........do....	(1 3)	(1 3)	(1 3)	(1 3)
Uranium and vanadium ores.........do....	(1)	(1)	(1)	(1)
Zinc.........do....	44,495	4,271,565	37,291	2,834,081
Miscellaneous [7].........	------------	5,145,403	------------	4,818,760
Total value, eliminating duplications......	------------	64,224,307	------------	40,301,788

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] From copper smelting.
[7] Includes minerals indicated by "1" above.

Mineral production of Vermont in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asbestos short tons	2,958	$94,130	(1)	(1)
Clay products		(1 2)		(1 2)
Clay, raw short tons	12,221	[3] 66,490	(1 3)	(1 3)
Copper pounds	(1)	(1)		
Lime short tons	45,963	406,921	30,226	$271,417
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Ore (copper) short tons	28,418	(5)		
Sand and gravel do	313,060	67,369	148,046	72,324
Scythestones do	(1)	(1)	(1)	(1)
Silver troy ounces	4,108	1,582		
Slate		2,463,241		1,508,518
Stone short tons	286,490	7,983,160	346,630	6,051,294
Talc do	45,881	399,548	38,424	318,322
Miscellaneous [6]		221,442		222,036
Total value, eliminating duplications		11,637,393		8,421,911

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

Mineral production of Virginia in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Barite short tons	10,250	$73,168	(1)	(1)
Briquets, fuel do	(1 2)	(1 2)	(1 2)	(1 2)
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[3] 2,380,100		[3] $1,400,728
Clay, raw short tons	7,358	[2] 50,177	2,672	[2] 14,286
Coal do	10,907,377	17,520,000	9,698,680	14,060,000
Coke do	219,656	[2] 846,542	99,305	[2] 364,854
Diatomite do	518	4,301		
Feldspar (crude) long tons	6,760	38,048	9,331	48,545
Ferro-alloys do	(1 2)	(1 2)	(1 2)	(1 2)
Gypsum short tons	(1)	(1)	(1)	(1)
Iron ore long tons	36,178	65,528		
Iron, pig do	50,629	(1 2)	26,519	(1 2)
Lead short tons	(1)	(1)	(1)	(1)
Lime do	146,996	960,219	100,659	654,665
Manganese ore long tons	3,853	(1)	1,505	30,807
Manganiferous ore do	193	1,560		
Marl, calcareous short tons	7,889	19,410	6,544	17,034
Mica:				
Scrap do	(1)	(1)	371	4,044
Sheet pounds	(1)	(1)	6,554	601
Millstones		(1)		500
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Ores (crude), etc.:				
Lead-zinc short tons	(5)	(6)	(5)	(6)
Zinc do	1,000	(6)	6,700	(6)
Pyrites long tons	(1)	(1)	(1)	(1)
Salt short tons	(1)	(1)	(1)	(1)
Sand and gravel do	1,470,380	997,227	1,229,683	809,432
Slate		[7] 303,335		[7] 185,638
Stone short tons	3,793,700	3,852,535	3,044,530	2,907,238
Talc and soapstone do	(1)	(1)	(1)	(1)
Titanium minerals:				
Ilmenite do	(1)	(1)	(1)	(1)
Rutile do	(1)	(1)	(1)	(1)
Zinc do	(1)	(1)	(1)	(1)
Miscellaneous [8]		11,370,829		7,897,812
Total value, eliminating duplications		34,602,749		26,150,041

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census
[4] No canvass.
[5] Bureau of Mines not at liberty to publish figures.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of granules, etc., value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral production of Washington in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Asbestos ... short tons	(1)	(1)	(1)	(1)
Briquets, fuel ... do	36,924	[2] $272,828	19,770	[2] $136,258
Cement ... barrels	(1)	(1)	(1)	(1)
Clay products	------	[3] 2,400,782	------	[3] 1,503,238
Clay, raw ... short tons	28,784	[2] 24,647	21,322	[2] 20,801
Coal ... do	2,301,928	7,439,000	1,846,461	5,800,000
Coke ... do	48,473	[2] 355,323	30,686	[2] 215,782
Copper ... pounds	1,206,438	156,837	202,503	18,428
Diatomite ... short tons	840	14,800	779	11,186
Gold ... troy ounces	4,245	87,748	2,904	60,035
Iron ore ... long tons	------	------	1,032	(1)
Lead ... short tons	576	57,629	1,386	102,531
Lime ... do	26,913	266,131	20,619	215,033
Magnesite ... do	(1)	(1)	(1)	(1)
Mercury ... flasks (76 pounds)	1,079	124,095	560	48,917
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	(1)	(1)	(1)	(1)
Ores (crude), etc.:				
Copper ... short tons	28,565	(5)	5,063	(5)
Dry and siliceous (gold and silver) ... do	7,710	(5)	5,779	(5)
Lead ... do	1,981	(5)	239	(5)
Lead-zinc ... do	7,200	(5)	80,968	(5)
Pulpstones ... do	(1)	(1)	(1)	(1)
Sand and gravel ... do	5,307,622	2,181,012	3,195,156	1,405,551
Sand-lime brick ... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silica (quartz) ... short tons	(1)	(1)	------	------
Silver ... troy ounces	32,816	12,634	22,410	6,499
Stone ... short tons	[6] 1,773,610	[6] 1,782,493	1,836,150	1,743,453
Tungsten ore (60 per cent concentrates) ... do	7	(1)	(1)	(1)
Zinc ... do	352	33,782	4,974	378,005
Miscellaneous [7]	------	5,518,901	------	3,507,732
Total value, eliminating duplications	------	20,075,844	------	14,800,608

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census. [4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of marble, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "[1]" and "[6]" above.

Mineral production of West Virginia in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Briquets, fuel ... short tons	102,835	[1] $512,322	(1 2)	(1 2)
Bromine ... pounds	(2)	(2)	(2)	(2)
Calcium chloride ... short tons	(2)	(2)	(2)	(2)
Cement ... barrels	(2)	(2)	(2)	(2)
Clay products	------	[3] 15,954,195	------	[3] $14,099,394
Clay, raw ... short tons	46,079	[1] 68,409	27,415	[1] 41,342
Coal ... do	121,472,638	181,722,000	101,473,172	132,762,000
Coke ... do	1,901,161	[1] 5,061,759	1,378,666	[1] 3,204,644
Ferro-alloys ... long tons	(1 2)	(1 2)	(1 2)	(1 2)
Grindstones and pulpstones ... short tons	5,100	361,135	2,870	150,664
Iron, pig ... long tons	704,654	(1 2)	593,831	(1 2)
Lime ... short tons	228,230	1,394,075	170,420	985,687
Manganese ore ... long tons	------	------	29	(2)
Marl, calcareous ... short tons	(2)	(2)	(2)	(2)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	144,180,000	66,553,000	124,797,000	58,123,000
Natural gasoline ... gallons	63,328,000	4,151,000	52,844,000	2,436,000
Petroleum ... barrels	5,071,000	11,820,000	4,472,000	7,070,000
Salt ... short tons	28,670	184,327	35,480	218,762
Sand and gravel ... do	2,695,437	2,813,284	2,128,786	2,118,434
Sand and sandstone (finely ground) ... do	(2)	(2)	(2)	(2)
Stone ... do	[5] 3,062,130	[5] 2,715,821	2,467,050	2,380,694
Sulphuric acid [6] ... do	(1 2)	(1 2)	(1 2)	(1 2)
Miscellaneous [7]	------	14,872,512	------	10,697,883
Total value, eliminating duplications	------	290,118,914	------	221,734,789

[1] Valued not included in total value for State.
[2] Value included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census. [4] No canvass.
[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[6] From zinc smelting.
[7] Includes minerals indicated by "[2]" and "[5]" above.

Mineral production of Wisconsin in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Barite, short tons	(1)	(1)	-------	-------
Briquets, fuel, do	564,621	[2] $4,640,722	(1 2)	(1 2)
Cement, barrels	(1)	(1)	(1)	(1)
Clay products	-------	[3] 2,778,533	-------	[3] $1,709,048
Clay, raw, short tons	140	[2] 240	-------	-------
Coke, do	(1 2)	(1 2)	(1 2)	(1 2)
Iron ore:				
Sold to furnaces, long tons	1,148,277	3,179,175	629,977	1,658,670
Sold for paint, do	1,372	(1)	76	204
Lead, short tons	1,537	153,700	952	70,448
Lime, do	64,989	598,739	42,621	372,244
Marl, calcareous, do	(1)	(1)	735	735
Mineral paints, zinc and lead pigments, do	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters, gallons sold	(4)	(4)	(4)	(4)
Ores (crude), etc.:				
Lead-zinc, short tons	457,000	(5)	318,700	(5)
Zinc, do	29,400	(5)	-------	-------
Pyrites, long tons	13,541	(1)	9,764	(1)
Sand and gravel, short tons	7,082,063	2,801,713	5,151,686	1,960,984
Sand and sandstone (finely ground), do	(1)	(1)	(1)	(1)
Sand-lime brick, thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silica (quartz), short tons	(1)	(1)	(1)	(1)
Stone, do	[6] 3,370,750	[6] 5,100,266	[6] 2,627,140	[6] 4,080,275
Sulphuric acid [7], do	(1 2)	(1 2)	(1 2)	(1 2)
Talc, do	1,078	3,499	3,583	11,646
Zinc, do	12,558	1,205,568	10,088	766,688
Miscellaneous [8]	-------	7,024,577	-------	7,585,526
Total value, eliminating duplications	-------	17,711,394	-------	11,843,343

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of basalt, value for which is included under "Miscellaneous."
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of Wyoming in 1930 and 1931

Product	1930		1931	
	Quantity	Value	Quantity	Value
Cement, barrels	(1)	(1)	(1)	(1)
Clay products	-------	[2] $177,445	-------	(1 2)
Clay, raw, short tons	25,010	[3] 249,797	16,080	[3] $143,969
Coal, do	6,088,133	15,133,000	4,993,686	11,996,000
Copper, pounds	11,600	1,508	9,000	819
Gold, troy ounces	443	9,158	56	1,165
Gypsum, short tons	(1)	(1)	(1)	(1)
Iron ore, long tons	320,023	(1)	180,771	(1)
Lime, short tons	(1)	(1)	-------	-------
Mineral waters, gallons sold	(4)	(4)	(4)	(4)
Natural gas, M cubic feet	43,219,000	4,277,000	39,770,000	4,153,500
Natural gasoline, gallons	51,132,000	3,338,000	51,523,000	1,797,000
Ores (crude), etc.:				
Copper, short tons	112	(5)	18	(5)
Dry and siliceous (gold and silver), do	1,173	(5)	5	(5)
Petroleum, barrels	17,868,000	22,350,000	14,834,000	11,120,000
Phosphate rock, long tons	1,339	6,000	1,000	4,500
Sand and gravel, short tons	(1)	(1)	(1)	(1)
Silver, troy ounces	122	47	17	5
Sodium salts (carbonate and sulphate) from natural sources, short tons	(1)	(1)	6,490	29,662
Stone, do	[6] 207,380	[6] 343,637	[6] 167,090	[6] 236,696
Miscellaneous [7]	-------	1,099,389	-------	1,553,316
Total value, eliminating duplications	-------	46,735,184	-------	30,892,663

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of sandstone in 1930 and of unclassified stone in 1931, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

PREFATORY NOTE TO THE REPORTS ON GOLD, SILVER, COPPER, LEAD, AND ZINC

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In the mining industry, gold, silver, copper, lead, and zinc are closely related in both the genesis and the geologic occurrence of their ores, as well as in mining and in metallurgical treatment. Of their ores some contain all five metals, many contain three or four, and few contain only one. Gold and silver, for instance, almost everywhere show close genetic relations, and their ores are usually mined together. Lead and zinc constitute a similar pair. Copper ores almost invariably yield some silver and gold as well as copper, and most lead ores yield notable supplies of silver. Zinc ores in the Western States contribute also to the production of silver. All five metals may occur in commercial quantity in a single mine or, more commonly, in a single mining district. For these reasons each of these metals is treated in Mineral Resources in a general report, and all five metals are grouped together in "mine reports" descriptive of individual or geographically grouped States. These reports are printed in 15 pamphlets.

To facilitate advance publication each report is published separately at the earliest date possible. The general reports give figures of the output of the metals in the first marketable form, as obtained from the smelters, refineries, and mints, together with general reviews of the respective industries for the entire country. The figures given in the general reports represent the final official statistics of production for the country and of the States. The general report on gold and silver includes the statistics of recovered precious metals as determined by the Bureau of the Mint. The "mine reports" give figures of the production (called "mine production") as obtained from the mines, so far as possible in terms of both gross and recoverable metal in ores and other material sold or treated during the year; they also supply information in detail relative to the mining industry in the respective States, counties, and mining districts.

These reports, which appear as separate chapters in this volume, are as follows:

Gold and silver (general report).
Copper (general report).
Lead (general report).
Zinc (general report).
Silver, copper, lead, and zinc in the Central States (mine report).
Gold, silver, copper, lead, and zinc in the Eastern States (mine report).
Gold, silver, copper, lead, and zinc in Arizona (mine report).
Gold, silver, copper, lead, and zinc in California and Oregon (mine report).

Gold, silver, copper, lead, and zinc in Colorado (mine report).
Gold, silver, copper, lead, and zinc in Idaho and Washington (mine report).
Gold, silver, copper, lead, and zinc in Montana (mine report).
Gold, silver, copper, lead, and zinc in Nevada (mine report).
Gold, silver, copper, lead, and zinc in New Mexico and Texas (mine report).
Gold, silver, copper, and lead in South Dakota and Wyoming (mine report).
Gold, silver, copper, lead, and zinc in Utah (mine report).

In stating quantity of ores, concentrates, and similar material the short ton of 2,000 pounds is used throughout. The term "ore" as used here denotes any metalliferous material treated at the mine or shipped to reduction plants and paid for by those plants, whether or not it nets a profit to the miner. The ore classification is necessarily arbitrary, because of the varying factors affecting mining and treatment of ores. Dry and siliceous ores comprise gold and silver ores proper, as well as fluxing ores that carry considerable quantities of iron and manganese oxides and very small quantities of gold and silver and also gold and silver ores that carry copper, lead, or zinc in quantities too low to classify them as copper, lead, zinc, or mixed ores. The copper ores include the great disseminated copper deposits of the West, the copper ores of the Lake Superior region, and other ores in which copper is the most abundant base metal paid for. The lead and zinc ores are those in which lead or zinc is the only or chief base metal present, irrespective of their precious-metal content. The mixed ores are those whose commercial value depends on the recoverable or recovered contents of two or more base metals in addition to any precious metals they may contain. If one of the metals, though present in sufficient quantity, is not recovered, that metal is disregarded in naming the ore. An improvement in metallurgy may later serve to change the name of such ore. The classification based on methods of treatment is the only satisfactory commercial classification.

It is to be understood, of course, that market values are not received by producers for metals in ore and intermediate products nor always for metals in marketable form, that payment is made in accordance with contracts for treatment or sale, and therefore that average daily quotations do not necessarily agree with average prices received.

Prices of silver, copper, lead, and zinc, 1850–1931

Year	Silver [1]	Copper [2]	Lead [3]	Zinc [4]	Year	Silver [1]	Copper [2]	Lead [3]	Zinc [4]
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1850	$1.32	$0.22	$0.05	---------	1891	$0.99	$0.128	$0.043	$0.05
1851	1.34	.166	.05	---------	1892	.87	.116	.041	.046
1852	1.33	.22	.05	---------	1893	.78	.108	.037	.04
1853	1.35	.22	.06	$0.055	1894	.63	.095	.033	.035
1854	1.35	.22	.06	---------	1895	.65	.107	.032	.036
1855	1.34	.27	.07	---------	1896	.68	.108	.03	.039
1856	1.34	.27	.066	---------	1897	.60	.12	.036	.041
1857	1.35	.25	.06	---------	1898	.59	.124	.038	.046
1858	1.34	.23	.06	---------	1899	.60	.171	.045	.058
1859	1.36	.22	.055	---------	1900	.62	.166	.044	.044
1860	1.35	.23	.056	---------	1901	.60	.167	.043	.041
1861	1.33	.22	.05	---------	1902	.53	.122	.041	.048
1862	1.35	.22	.06	---------	1903	.54	.137	.042	.054
1863	1.345	.34	.06	---------	1904	.58	.128	.043	.051
1864	1.345	.47	.07	.139	1905	.61	.156	.047	.059
1865	1.337	.392	.066	---------	1906	.68	.193	.057	.061
1866	1.339	.342	.07	---------	1907	.66	.20	.053	.059
1867	1.33	.254	.065	---------	1908	.53	.132	.042	.047
1868	1.326	.23	.065	---------	1909	.52	.13	.043	.054
1869	1.325	.242	.06	---------	1910	.54	.127	.044	.054
1870	1.328	.212	.06	---------	1911	.53	.125	.045	.057
1871	1.325	.241	.06	---------	1912	.615	.165	.045	.069
1872	1.322	.356	.064	---------	1913	.604	.155	.044	.056
1873	1.297	.280	.06	---------	1914	.553	.133	.039	.051
1874	1.278	.220	.06	---------	1915	.507	.175	.047	.124
1875	1.24	.227	.058	.07	1916	.658	.246	.069	.134
1876	1.16	.21	.061	.072	1917	.824	.273	.086	.102
1877	1.20	.19	.055	.06	1918	1.00	.247	.071	.091
1878	1.15	.166	.036	.049	1919	1.12	.186	.053	.073
1879	1.12	.186	.041	.052	1920	1.09	.184	.08	.081
1880	1.15	.214	.05	.055	1921	1.00	.129	.045	.05
1881	1.13	.182	.048	.052	1922	1.00	.135	.055	.057
1882	1.14	.191	.049	.053	1923	.82	.147	.07	.068
1883	1.11	.165	.043	.045	1924	.67	.131	.08	.065
1884	1.11	.13	.037	.044	1925	.694	.142	.087	.076
1885	1.07	.108	.040	.043	1926	.624	.14	.08	.075
1886	.99	.111	.046	.044	1927	.567	.131	.063	.064
1887	.98	.138	.045	.046	1928	.585	.144	.058	.061
1888	.94	.168	.044	.049	1929	.533	.176	.063	.066
1889	.94	.135	.039	.05	1930	.385	.130	.050	.048
1890	1.05	.156	.045	.055	1931	.290	.091	.037	.038

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[1] Report of Director of the Mint, pp. 212–213, 1914. Equivalent value of fine ounce based on average price and average rate of exchange. For 1916, 1917, and 1919, dealers' buying price, New York. For 1918, early estimate furnished by the Bureau of the Mint. For 1920 to 1922, New York market price for domestic silver only. For 1923, average price under Pittman Act, from Jan. 1 to June 2, for domestic silver; average New York price for all silver after that period. For 1924 and later years, average New York price for bar silver.

[2] Weed, W. H., Copper Handbook, vol. 11, pp. 1339, 1343, for years 1850–1903. By computation from data for years 1850–1860, p. 1339. U. S. Geological Survey computations for electrolytic copper since 1904. For 1916 and later years, average price all marketable grades.

[3] New York price, Ingalls, W. R., Lead and Zinc in the United States, p. 203, 1908. U. S. Geological Survey since 1904. For 1916, outside spot quotations, New York. For 1917 and later years, average price all grades.

[4] New York price, 1875–1904, Ingalls, W. R., Lead and Zinc in the United States, p. 342, 1908. St. Louis price, U. S. Geological Survey, since 1904. For 1915 and later years, average price all grades. Oral communication from C. E. Siebenthal, of the U. S. Geological Survey, for 1853 and 1864.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE EASTERN STATES[1] [2]

(MINE REPORT)

By J. P. DUNLOP

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SUMMARY

The mines of the Eastern States yielded metals in 1931 valued at $18,179,046, as follows: Gold, $23,827; silver, $18,545; copper, $2,124,486; lead, $590,076; and zinc, $15,422,112. The quantity of each metal produced was less in 1931 than in 1930, and the total value decreased $6,808,915. Much of the decrease was due to the decline in the average prices of silver, copper, lead, and zinc and to the large decrease in the quantity of copper. The output of lead and zinc decreased much less in the Eastern States than in other parts of the United States. The decrease in the output of silver was due chiefly to the smaller quantity of copper ore smelted in Tennessee.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1922–1931

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1922	$1.00	$0.135	$0.055	$0.057	1927	$0.567	$0.131	$0.063	$0.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048
1926	.624	.140	.080	.075	1931	.290	.091	.037	.038

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[1] Work on manuscript completed May, 1932.

[2] Mineral Resources, 1908, Pt. I, pp. 645 to 681, contains references to the geology of the Eastern States and gives a list of the U. S. Geological Survey, State survey, and other publications that deal with the geology and mines of those States; Mineral Resources, 1914, Pt. I, pp. 139 to 163, contains a historical review of the production of gold in the Southern Appalachian States and a list of U. S. Geological Survey publications on gold, silver, copper, lead, and zinc in the Eastern States.

Mine production of gold, silver, copper, lead, and zinc in the Eastern States, 1922–1931

Year	Mines producing	Ore sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
			Fine ounces	Value	Fine ounces	Value
1922	29	2, 274, 175	620. 22	$12, 821	80, 935	$80, 935
1923	21	2, 936, 637	576. 58	11, 919	108, 799	89, 215
1924	16	2, 851, 932	799. 88	16, 535	97, 628	65, 411
1925	19	3, 315, 912	1, 964. 60	40, 612	106, 228	73, 722
1926	21	2, 902, 670	694. 23	14, 351	106, 539	66, 480
1927	15	3, 201, 195	825. 96	17, 074	84, 293	47, 794
1928	21	3, 770, 070	1, 697. 82	35, 097	102, 520	59, 974
1929	25	4, 345, 149	1, 779. 86	36, 793	111, 660	59, 515
1930	24	4, 160, 831	2, 256. 06	46, 637	123, 590	47, 582
1931	27	3, 255, 518	1, 152. 63	23, 827	63, 949	18, 545

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1922	15, 476, 497	$2, 089, 327	1, 472, 000	$80, 960	188, 082, 000	$13, 616, 990	$15, 881, 033
1923	20, 487, 395	3, 011, 647	2, 500, 000	175, 000	199, 180, 000	14, 765, 885	18, 053, 666
1924	19, 450, 329	2, 547, 993	4, 424, 000	353, 920	212, 148, 000	16, 875, 606	19, 859, 465
1925	20, 824, 058	2, 957, 016	5, 354, 000	465, 798	226, 814, 000	18, 531, 644	22, 068, 792
1926	21, 567, 100	3, 019, 394	6, 500, 000	520, 000	207, 196, 000	16, 365, 050	19, 985, 275
1927	22, 327, 734	2, 924, 933	4, 786, 000	301, 518	236, 340, 000	16, 836, 047	20, 127, 366
1928	29, 559, 146	4, 256, 517	(1)	(1)	288, 090, 000	19, 516, 228	(1)
1929	34, 045, 920	5, 992, 082	(1)	(1)	309, 096, 000	21, 920, 456	(1)
1930	38, 232, 031	4, 970, 164	16, 734, 000	836, 700	336, 488, 000	19, 086, 878	24, 987, 961
1931	23, 346, 000	2, 124, 486	15, 948, 000	590, 076	313, 394, 000	15, 422, 112	18, 179, 046

[1] Bureau of Mines not at liberty to publish figures for lead.

GOLD AND SILVER

In the Eastern States the output of gold was $23,827 in 1931, compared with $46,637 in 1930. The gold lode mines and placer mines, which formerly yielded nearly all the gold, produced only $5,302 (22 per cent of the total) in 1931. As this output was the yield from 4 lode gold mines and 10 placer mines the average recovery was less than $400 per mine; none of the mines operated yielded as much as $1,100. Most of the operations at the lode gold mines were experimental, only 450 tons of siliceous ore being treated; the 10 placers yielded $3,434 in gold. About one-half of the placer gold came from North Carolina and the remainder from Alabama, Georgia, and South Carolina. All the gold from siliceous ore came from Georgia and North Carolina. The decreased yield of gold in 1931 was due largely to decreased smelter recoveries from copper ore mined in Tennessee and North Carolina and to smaller recovery from pyritiferous magnetite ore mined in Pennsylvania. Refining of copper bullion from ore mined in North Carolina, Pennsylvania, and Tennessee yielded $18,525 in gold, of which $5,200 came from Pennsylvania pyritiferous magnetite ore. The value of the estimated output of gold in the Southern Appalachian States for the period 1799 to 1931 is recorded as $51,223,004.

Of the silver (63,949 ounces) produced in the Eastern States in 1931 all except 28 ounces from placer bullion and 21 ounces from lode gold mines was derived from copper bullion recovered from copper ore and pyritiferous magnetite ore. Mines in North Carolina and

Tennessee produced most of the silver; nearly all the rest came from Pennsylvania.

Mine production of gold and silver in the Eastern States in 1931, by States

State	Gold		Silver		Increase or decrease in value as compared with 1930	
	Fine ounces	Value	Fine ounces	Value	Gold	Silver
Alabama	19.69	$407	3	$1	−$43	
Georgia	88.38	1,827	12	3	−2,367	−$6
North Carolina	367.55	7,598	20,333	5,897	−6,984	−5,674
Pennsylvania	251.55	5,200	2,600	754	−7,823	−1,464
South Carolina	22.74	470	1		+470	
Tennessee	402.72	8,325	41,000	11,890	−6,063	−20,311
Vermont						−1,582
	1,152.63	23,827	63,949	18,545	−22,810	−29,037
Total, 1930	2,256.06	46,637	123,590	47,582		

Mine production of gold and silver in the Eastern States in 1931, by sources, in fine ounces

State	Gold			Silver		
	Placers	Dry and siliceous ore	Copper ore	Placers	Dry and siliceous ore	Copper ore
Alabama	19.69			3		
Georgia	37.78	50.60		3	9	
North Carolina	85.91	39.76	241.88	21	12	20,300
Pennsylvania			251.55			2,600
South Carolina	22.74			1		
Tennessee			402.72			41,000
	166.12	90.36	896.15	28	21	63,900
Total, 1930	81.56	326.05	1,848.45	10	70	123,510

COPPER

The mine production of copper in the Eastern States in 1931 was 23,346,000 pounds, valued at $2,124,486, a decrease of 14,886,031 pounds from that in 1930; each of the producing States showed a decrease. The output was derived from copper ore mined in North Carolina and Tennessee and from copper concentrates recovered from Pennsylvania pyritiferous magnetite ore mined for its iron content. Exclusive of the magnetite ore, which yielded about 2.43 pounds of copper to the ton, the average yield of copper from copper ore was 1.93 per cent, or 38.6 pounds to the ton. The copper ore also yielded $0.054 in gold and silver to the ton. The copper concentrates from magnetite ore contained about 24.2 per cent of copper and $2.43 to the ton in gold and silver. Copper ore directly smelted amounted to 150,901 tons, from which 12,332,320 pounds of copper were recovered. Copper and magnetite ores concentrated amounted to 912,375 tons and yielded 30,399 tons of copper concentrates, from which 11,013,680 pounds of copper were recovered.

LEAD

The output of lead from mines in the Eastern States in 1931 was all from lead-zinc ores mined at the Austinville mine in Virginia, the Balmat mine in New York, and the Embree mine in Tennessee. The total quantity of lead recovered in 1931 was 15,948,000 pounds, or 786,000 pounds less than in 1930. Lead concentrates shipped amounted to 13,036 tons.

ZINC

The recoverable zinc in the ore mined and shipped in the Eastern States in 1931 was 313,394,000 pounds, valued at $15,422,112, compared with 336,488,000 pounds, valued at $19,086,878, in 1930.

[N. B.—The value of the zinc in New Jersey is not that of ore mined. It is the estimated smelting value of the recoverable zinc content of the ore after freight, haulage, smelting, and manufacturing charges are added.]

In 1931, 640,560 tons of zinc ore were mined in New Jersey; 269,582 tons of zinc ore and old tailings and zinc-lead ore were treated in New York; in Virginia zinc ore was mined by the Ivanhoe Mining & Smelting Co. and lead-zinc ore by the Bertha Mineral Co.; and the zinc-bearing ore mined in Tennessee was mainly sulphide zinc ore, with a small proportion of zinc carbonate ore and lead-zinc ore, and a small part of the zinc from Tennessee was contained in zinc concentrates derived from copper ores of the Ducktown district. All the zinc ore and lead-zinc ore was concentrated except the part of the New Jersey crude ore that was directly smelted. The recoverable zinc, as metal or in oxide, in the ore and old tailings from New York in 1931 was 48,200,000 pounds; Tennessee and Virginia contributed 76,624,000 pounds of zinc, or nearly 20,000,000 pounds less than in 1930. Tennessee and New York both increased slightly in output of zinc in 1931. The total zinc concentrates shipped in 1931 amounted to 600,114 tons, of which 49,073 tons were from New York and 74,064 tons from Virginia and Tennessee.

REVIEW BY STATES

Alabama.—The value of the gold produced in Alabama during the period 1830 to 1931 is recorded as $767,806. The gold lode mines were inactive in 1931, and the only gold produced came from the Arbacoochie placers in Cleburne County near Oxford.

Georgia.—The value of the gold produced in Georgia during the period 1830 to 1931 is recorded as $17,853,679, or about one-third of the total recorded yield of the Southern Appalachian States. In 1931 two mines yielded $1,827 in gold and 12 ounces of silver, compared with an output of $4,194 in gold and 23 ounces of silver in 1930; all the production in both years came from Lumpkin County. The producing mines in 1931 were the Crown Mountain mine at Dahlonega and the Josephine placer mine at Auraria, the latter operated by the Totabie Co. (Inc.). Dr. Craig R. Arnold acquired all the property of the Water Power & Mining Co. at Dahlonega, including the Barlow, Hand, Findley, Yahoola, Mary Deary, and other mines. Only experimental mill work and prospecting were done by Doctor Arnold in 1931. There is some prospect that the Dahlonega and Auraria mines may have a larger output in 1932.

Maine, Maryland, New Hampshire, and Vermont.—No production of gold, silver, or copper was reported for 1931 from any of the mines in Maine, Maryland, New Hampshire, or Vermont. The estimated total gold production of Maryland has been $71,405, virtually all of which was produced prior to 1906. The old Elizabeth copper mine and 400-ton mill at South Strafford,[3] Orange County, Vt., owned by the National Copper Co., made no production in 1931.

New Jersey (see also note on p. 4).—The production of zinc ore in New Jersey in 1931 was 640,560 tons containing 188,570,000 pounds of recoverable zinc. All the ore mined was treated by the producer.

New York.—The quantity of zinc ore and old tailings milled in New York in 1931 was 93,148 tons, and the quantity of lead-zinc ore was 176,434 tons. The concentrates shipped in 1931 yielded 24,100 tons of zinc as metal or in oxide. The old Edwards property [4] of the St. Joseph Lead Co. is equipped with a 500-ton all-flotation mill; the zinc sulphide ore mined was taken from levels down to 1,600 feet. The ore contains no appreciable quantity of lead. The Balmat mine of the St. Joseph Lead Co. near Sylvan Lake was operated steadily in 1931. This mine is opened by a 300-foot shaft and is equipped with a 500-ton flotation plant. The ore body at the Balmat mine is lead-zinc sulphide, and large shipments of both zinc and lead concentrates were made. The zinc concentrates are shipped to the new oxide plant in Pennsylvania, which was completed early in 1931.

North Carolina.—The value of the gold produced in North Carolina during the period 1799 to 1931 is recorded as $23,690,687. The yield of gold decreased from $14,582 in 1930 to $7,598 in 1931. Placer mines produced $1,776 in gold, lode gold mines $822, and copper bullion $5,000. The output of placer gold came from seven small operations, and three mines treated gold ore or old tailings. The placer mines, none of which yielded more than $700, were the Coley in Catawba County, the Furr in Cabarrus County, the Zachary in Jackson County, the Lindsey in Guilford County, the Rhyne and the Small in Rutherford County, and the Stewart in Stanly County. The Centrifugal Recoveries Co. made a small output from the Black Ankle mine near Troy in Montgomery County, and the Rowan Mining Corporation made a small output during development at the Gold Hill mine in Rowan County. The old Cullowhee copper mine in Jackson County was idle in 1931 owing to the low price of copper. The Fontana mine in Swain County, now owned by the North Carolina Exploration Co., shipped crude copper ore to the Ducktown Chemical & Iron Co. during January, 1931, and to the Tennessee Copper Co. during the remainder of the year. The crude ore contains good values in copper, and the larger part of the gold and silver credited to North Carolina in 1931 came from refining the copper bullion derived from the Fontana mine.

Pennsylvania.—The Cornwall mines in Lebanon County were operated in 1931 at less than 50 per cent of the 1930 rate, and only 2,451 tons of copper concentrates were shipped. The ore mined is pyritiferous magnetite, and the tailings from the iron concentrates go to the flotation plant. The copper concentrates, which contained about 24.2 per cent of copper and $2.43 to the ton in gold and silver, were shipped to the Nichols Copper Co. The silver content of the copper concentrates was about 1 ounce to the ton.

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[3] Anderson, C. A., Vermont Copper Area: Eng. and Min. Jour., Mar. 9, 1931, pp. 208–209.

[4] Knaebel, J. B., Mining Practice at the Edwards Mine of the St. Joseph Lead Co., St. Lawrence County N. Y.: Information Circ. 6586, Bureau of Mines, 1932, 25 pp.

South Carolina.—Mines in South Carolina yielded $5,183,285 in gold during the period 1829 to 1931. The only output of gold reported for 1931 was from the Brewer placer near Jefferson, Chesterfield County, owned by E. M. Croxton; J. F. Hartman recovered the gold by panning in July and August.

Tennessee.—Mines in Tennessee produced $357,706 in gold during the period 1831 to 1931. Most of the output prior to 1879 was from placer mines in Monroe County; however, these placers have been unproductive (except in 1928) for many years, and the gold output since 1906 has been almost entirely from copper ore mined in Polk County. There were large decreases in the quantity of gold, silver, and copper from mines in Tennessee in 1931 but increases in the quantity of lead and zinc. The total value of each of the metals except lead was much less in 1931 than in 1930. The output of copper decreased at least 30 per cent, and copper bullion from two properties was the only source of gold and silver.

Mine production of gold, silver, copper, lead, and zinc in Tennessee, 1922–1931

Year	Ore sold or treated	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1922	983,844	$4,320	78,341	14,240,571	1,464,000	31,136,000	$3,860,410
1923	1,355,547	6,615	105,712	18,721,932	2,500,000	31,800,000	5,182,823
1924	1,443,159	6,800	94,779	18,335,635	1,874,000	28,752,000	4,491,070
1925	1,711,298	7,421	102,949	19,788,234	896,000	32,512,000	5,437,660
1926	1,114,400	8,622	104,000	18,606,664	1,600,000	24,196,000	4,621,151
1927	1,152,155	8,816	81,460	14,940,595	----------	20,800,000	3,343,421
1928	1,330,194	11,117	75,558	16,374,261	----------	[1] 65,834,000	[1] 6,429,086
1929	1,507,980	11,680	81,281	(2)	----------	[1] 81,116,000	(2)
1930	1,499,255	14,388	83,640	(2)	(2)	[1] 96,294,000	[1] 7,421,963
1931	1,290,338	8,325	41,000	(2)	(2)	[1] 76,624,000	[1] 4,164,853

[1] Includes zinc from Virginia, for which Bureau of Mines is not at liberty to publish figures.

(2) Bureau of Mines not at liberty to publish figures for copper and lead.

The Tennessee Copper Co.[5] ran its 900-ton flotation plant, 1,500-ton blast furnace, one converter, sulphuric acid plant, and copper sulphate works on sulphide ore from its own mines in Tennessee and on sulphide copper ore from the Fontana mine in Swain County, N. C. The ore from the Fontana mine went to the Ducktown Chemical & Iron Co. for about 30 days early in 1931 and thereafter to the Tennessee Copper Co. About 9,200 feet of development work were done in 1931. The zinc flotation plant also was operated, and a good output of 49.4 per cent zinc concentrates was shipped.

The Ducktown Chemical & Iron Co.[6] operated its flotation plant and 700-ton blast furnace on sulphide copper ore and concentrates produced in 1931 from the Isabella and Mary mines in Tennessee, on stocked crude copper ore, and on crude copper ore shipped early in 1931 from the Fontana mine in North Carolina. The Mary mine was abandoned in April, 1931, and the smelter was closed until November, when it was operated for two weeks before it closed for an indefinite period.

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[5] McNaughton, C. H., Mining Methods of the Tennessee Copper Co., Ducktown, Tenn.: Information Circ. 6149, Bureau of Mines, 1929, 17 pp.

[6] Kegler, V. L., Mining Methods of the Ducktown Chemical and Iron Co., Mary Mine, Isabella, Tenn.: Information Circ. 6397, Bureau of Mines, 1931, 9 pp.

The Universal Exploration Co. operated its old 100-ton plant on zinc carbonate ore in 1931 for a brief period only but kept its 800-ton all-flotation plant running steadily on zinc sulphide ore mined through two 200-foot shafts. A small quantity of zinc carbonate and a large quantity of 64.69 per cent blende concentrates were shipped. These concentrates had a higher zinc content for carload lots than any blende concentrates shipped in the United States.

The Embree Iron Co. in Washington County shipped less high-grade zinc carbonate concentrates in 1931 than in 1930 but increased its output of galena concentrates. Fred Caldwell of New Market also shipped considerable zinc carbonate. Operations at the Mascot mine of the American Zinc Co. of Tennessee[7] were continuous in 1931, and the output was about the same as in 1930. The concentrates from the mine average about 61 per cent of zinc. No lead concentrates were produced.

Virginia.—The value of the gold produced from mines in Virginia during the period 1828 to 1931 is recorded as $3,298,436, of which only about $9,200 was produced during the last 21 years. No production of gold has been reported from Virginia since 1926. The production of both lead and zinc decreased in 1931. There were only two producers of zinc and one producer of lead, and the Bureau of Mines is not at liberty to publish the figures. Sulphide lead-zinc ore was treated by the Bertha Mineral Co. at its Austinville 1,500-ton mill, which ran all year. The Ivanhoe Mining & Smelting Co. produced some oxidized zinc ore from several shafts averaging 80 feet in depth. The old Waller mine near Tabscott, which is reported to have been a large producer of gold many years ago, was being prospected in 1931 by Leo Faust who expects to unwater the 500-foot level and explore the old drifts.

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[7] Coy, H. A., Mining Methods and Costs, American Zinc Co. of Tennessee, Mascot, Tenn.: Information Circ. 6239, Bureau of Mines, 1930, 11 pp.
Strachan, C. B., Milling Methods of the American Zinc Co. of Tennessee, Mascot, Tenn.: Information Circ. 6379, Bureau of Mines, 1930, 12 pp.

ARSENIC, BISMUTH, SELENIUM, AND TELLURIUM [1]

By C. N. GERRY and H. M. MEYER [2]

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ARSENIC

PRODUCTION AND SALES

Production of arsenic as arsenious oxide in the United States in 1931 amounted to 17,137 short tons, of which most (14,482 tons) was refined and the remainder (2,655 tons) was crude. The entire output in 1931, as in 1929 and 1930, was a by-product from smelting copper and lead ores. The products for the market consisted of refined white arsenic, crude white arsenic, "black" dust, and "treater" dust. No production of red arsenic sulphide or elemental arsenic was reported in 1931.

No arsenic was produced at Jardine, Mont., as the arsenic kitchens at the Jardine mine, which yields gold and arsenic from arsenopyrite, have been idle since 1927. Virtually all the arsenic made at the copper smelter of the Anaconda Copper Mining Co., Anaconda, Mont., resulted from the smelting of copper concentrates, chiefly from the Butte mines where arsenic occurs as enargite. In Utah the arsenic deposits (chiefly arsenopyrite and scorodite) of Gold Hill, Tooele County, remained idle. There are several deposits in Utah, Colorado, Washington, and other Western States that could be operated as arsenic mines if the demand justified. With an increased price due to a demand for insecticides or weed killer, it would be possible to increase the arsenic content of the charge of the lead smelters at Midvale and Murray, Utah, by shipments of arsenic ore from the Gold Hill or Western Utah mines at Gold Hill, Utah.

A total of 13,777 short tons of refined and crude arsenic was sold; it was valued at $796,744 (2.9 cents a pound). The refined white arsenic, 11,982 tons, was sold for $718,386 (3 cents a pound); the crude arsenic, 1,795 tons, was sold for $78,358 (2.18 cents a pound). The difference between the crude and refined arsenic produced in 1931 and that sold left an apparent stock of 3,360 tons on hand at the end of 1931; part of the crude arsenic produced was made directly into sodium arsenite or weed killer to be used in the West. Sales of crude and refined white arsenic by producers in the United States during the past 10 years are shown in the following table.

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[1] Work on manuscript completed July, 1932.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Crude and refined white arsenic sold by producers in the United States, 1922–1931

Year	Short tons		Value		Year	Short tons		Value	
	Refined	Crude	Total	Average (cents per pound)		Refined	Crude	Total	Average (cents per pound)
1922	8,905	1,122	$1,475,229	7.4	1927	10,020	1,540	$725,360	3.1
1923	12,357	1,914	2,808,801	9.8	1928	8,115	3,652	735,373	3.1
1924	12,270	2,183	2,655,015	9.2	1929	9,823	4,723	883,771	3.0
1925	11,240	1,077	1,199,247	4.9	1930	14,654	2,771	1,008,385	2.9
1926	10,977	828	674,350	2.9	1931	11,982	1,795	796,744	2.9

In 1930 much more refined arsenic was sold than was produced, the sales being partly from stock on hand; but in 1931, although there was no change in the price, 2,500 tons less were sold than produced.

IMPORTS AND EXPORTS

Arsenic compounds and metallic arsenic imported for consumption in the United States, 1927–1931

Year	Arsenious acid (white arsenic, As_2O_3)		Arsenic sulphide (realgar and orpiment)		Sheep dip		Paris green and London purple	
	Short tons	Value	Short tons	Value	Pounds	Value	Pounds	Value
1927	12,517	$921,998	206	$35,089	102,394	$8,952	----------	----------
1928	11,153	775,169	263	51,278	175,055	17,592	13,279	$1,497
1929	13,157	956,176	212	40,976	208,770	21,533	1,102	200
1930	10,471	725,991	277	47,235	174,215	18,517	19,024	1,595
1931	7,791	451,468	299	46,423	154,530	14,017	2,340	341

Year	Arsenic acid (H_3AsO_4)		Calcium arsenate		Lead arsenate		Metallic arsenic	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1927	11,685	$470	3,807	$717	----------	----------	245,686	$47,875
1928	75	30	1,323	233	----------	----------	186,622	35,584
1929	247	26	----------	----------	200	$26	287,545	50,730
1930	201	64	6,359	387	800	62	113,440	19,006
1931	12,061	430	40,950	2,125	----------	----------	28,661	4,649

White arsenic imported into the United States in 1931, by countries and districts

[General imports]

Country	Short tons	Value	District	Short tons	Value
Belgium	321	$23, 203	Buffalo	402	$28, 968
Canada	1, 532	114, 324	El Paso	983	39, 249
France	17	1, 079	Galveston	162	7, 991
Germany	66	4, 626	Hawaii	217	14, 004
Japan	1, 546	66, 324	Los Angeles	32	1, 963
Mexico	4, 298	241, 053	Maryland	674	31, 617
Netherlands	11	859	Massachusetts	29	1, 128
			Michigan	916	68, 837
			New Orleans	73	4, 640
			New York	1, 342	87, 573
			Ohio	94	7, 243
			Philadelphia	315	14, 577
			Pittsburgh	46	3, 447
			San Antonio	2, 166	124, 741
			San Francisco	340	15, 490
	7, 791	451, 468		7, 791	451, 468

Arsenic compounds exported from the United States, 1928–1931 [1]

Year	Calcium arsenate		Lead arsenate	
	Pounds	Value	Pounds	Value
1928	1, 178, 702	$67, 151	1, 093, 673	$141, 235
1929	3, 139, 633	171, 123	1, 563, 982	192, 185
1930	3, 177, 335	166, 647	2, 270, 980	263, 603
1931	2, 145, 653	101, 168	1, 788, 345	176, 212

[1] Not separately recorded by the Bureau of Foreign and Domestic Commerce prior to 1928.

MARKET IN 1931

DEMAND AND SUPPLY

Arsenic was produced as a by-product and sold in 1931 by three smelting companies, but only a little more than 80 per cent of the production was sold. Nearly two-thirds of the arsenic sold was recovered from the smelting of copper ore and concentrate; the remainder came from lead concentrate and iron concentrate. Montana and Utah ores were the chief sources of arsenic recovered at the smelting plants of the Anaconda Copper Mining Co., Anaconda, Mont.; the American Smelting & Refining Co., Tacoma, Wash., and Murray, Utah; and the United States Smelting, Refining & Mining Co., Midvale, Utah.

Insecticide manufacturers continued to be the largest consumers of the arsenic sold, utilizing more than 73 per cent of the total sales in 1931. Much of this arsenic is made into calcium arsenate which is used extensively in the South to control the boll weevil in the cotton fields. Requirements for arsenic weed killer, fungicides, and wood preservatives, made chiefly by western manufacturers, represented 12 per cent of the sales The glass industry took nearly 4 per cent, and most of the remainder (about 10 per cent) was sold for export. Refined white arsenic was sold chiefly to insecticide manufacturers; and crude arsenic, including crude white, "black" dust, "flue" dust, and "treater" dust, was sold for weed-killer and wood-preserving purposes. Part of the crude arsenic produced at Midvale was made directly into sodium arsenite, a liquid used in the West for sheep dip or insecticides. Details on the various uses of arsenic and its compounds and notes on the foreign production are given in a paper by P. M. Tyler and A. V. Petar, presented before the Baltimore General Meeting of the Electrochemical Society.[3]

Imports of crude and refined white arsenic during 1931 amounted to 7,791 short tons. This, added to the 17,137 tons produced in 1931, indicates 24,928 tons as the approximate total new supply of white arsenic available.

Mexico was credited with 4,298 tons of the arsenic imported in 1931; the arsenic was produced at the by-product plants of the Mexican lead works of the American Smelting & Refining Co. and the American Metal Co. Approximately three-fourths of it was sold for insecticides, and the remainder was used for glass manufacture. Canada exported to the United States 1,500 tons of white arsenic in addition to considerable arsenic contained in ores and concentrates shipped to smelters. Gold concentrates shipped from British Columbia and Alaska to the smelter at Tacoma, Wash., yielded arsenic. Most of the 1,546 tons of arsenic imported from Japan was recovered as a by-product from smelting copper ores. Belgium shipped 321 tons to the United States.

An interesting article [4] dealing with the smelting of ore from the Boliden mine stated that converter copper was made at the large new smelting plant in June, 1930, and the electrolytic refinery was completed and operated thereafter. The ore consists chiefly of arsenopyrite, chalcopyrite, and pyrite and contains an average of 10.8 per cent of arsenic compared with only 2.1 per cent of copper. Refined copper, gold, silver, and white arsenic are made for the market, and the plant includes space for the storage of a large quantity of crude arsenic.

PRICES

The price quoted in New York for white arsenic delivered at the consuming point seems to have been uniformly 4 cents a pound for large lots, with the usual increases for small lots. The price includes freight from the refinery to the buyer's works and barreling, freight and barreling together averaging about 1 cent. These charges account for the difference between quoted prices and the average sales prices reported by producers.

According to the Engineering and Mining Journal the English quotation for Cornish white ranged from £18 a long ton in January to £20 in July and increased further to £23 in December. The Mexican product was quoted at £17 10s. c. i. f. Liverpool from April to August, but it was not quoted in November and December.

Under the tariff act of 1930 arsenious acid or white arsenic is on the free list.

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[3] Tyler, P. M., and Petar, A. V., Arsenic: Electrochem. Soc., Preprint 61-33, 1932, pp. 431-436.

[4] Palén, A. G. Paul, Smelting at Rönnskär, Sweden: Eng. and Min. Jour., vol. 133, No. 6, June, 1932, p. 339.

WORLD PRODUCTION

World production of arsenic ore and white arsenic, 1926–1930, in metric tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country and product	1926	1927	1928	1929	1930
Algeria: Arsenate of lead—					
Gross weight	3,665	2,482	1,201	2,541	1,175
Arsenic content	733	546	144	305	353
Australia:					
New South Wales—					
Ore and concentrates [1]	[2] 1,796	755	5,924	2,814	6,809
White arsenic	202	(3)	50	255	809
Queensland—Ore	828	71	----------	----------	----------
Austria: Arsenic content of gold ores	237	155	14	----------	----------
Belgium: Luxemburg Economic Union—					
White arsenic [4]	1,711	2,201	2,659	3,717	3,111
Brazil: White arsenic	51	(3)	(3)	(3)	(3)
Canada:					
White arsenic	1,807	2,220	1,821	1,678	1,248
Arsenic content of ores and concentrates exported	495	605	643	694	804
Czechoslovakia: Ore—					
Gross weight	4	13	6	38	----------
Arsenic content	1	3	1	8	----------
France:					
Ore—					
Gross weight	23,256	56,822	69,362	43,263	48,667
Arsenic content	2,186	4,984	3,703	3,622	(3)
White arsenic	2,096	2,456	2,947	3,372	(3)
Germany:					
Ore—					
Gross weight	20,797	23,783	25,710	27,866	29,437
Arsenic content	1,310	1,498	1,619	1,756	1,858
White arsenic [4]	2,678	2,745	2,711	2,578	4,614
Great Britain:					
Ore [1]	----------	81	----------	20	----------
White arsenic and arsenic soot	1,693	1,358	1,314	968	588
Greece: White arsenic	1,148	1,036	709	763	841
Italy: Ore—					
Gross weight	200	81	----------	----------	----------
Arsenic content	35	20	----------	----------	----------
Japan: White arsenic	1,035	1,713	1,829	1,963	1,654
Mexico: White arsenic	6,445	11,332	12,933	[4] 9,665	10,128
Portugal:					
Ore [1]	7	47	(3)	9	(3)
White arsenic	354	(3)	134	105	176
Southern Rhodesia: White arsenic	49	38	102	52	50
Spain: Ore—					
Gross weight	190	186	----------	----------	----------
Arsenic content	29	28	----------	----------	----------
Sweden: Ore—					
Gross weight	13,149	22,100	22,728	22,919	21,649
Arsenic content	2,478	4,420	4,546	4,584	4,350
Turkey: Ore [1]	----------	----------	10	14	55
Union of South Africa: White arsenic	38	53	17	33	15
United States: White arsenic	10,709	10,487	10,675	13,196	15,808
Yugoslavia: Ore [1]	----------	----------	----------	----------	7

[1] Gross weight. Arsenic content not stated.
[2] Exclusive of output of Ottery mine, data for which are not available.
[3] Data not available.
[4] Exports of domestic product.

BISMUTH

Two producers reported an output of bismuth in 1931. Figures covering such production, however, are not available for publication.

Imports of bismuth and of compounds and salts of bismuth during the past 5 years are given in the following table.

Bismuth and "compounds, mixtures, and salts of bismuth" imported for consumption in the United States, 1927–1931

Year	Bismuth		Compounds, mixtures, and salts of bismuth	
	Pounds	Value	Pounds	Value
1927	47,732	$100,773	10,560	$15,080
1928	41,383	77,444	8,168	16,336
1929	37,480	58,853	3,552	16,645
1930	24,405	20,088	657	5,083
1931	7,718	8,191	951	5,318

The quoted price for bismuth at New York was $1.25 a pound, in ton lots, from November 19, 1930, until the week of March 12, 1931, when it advanced to $1.40; it dropped back to $1.25 during the following week. The high price for the year, $1.50 a pound, was reached in the week of March 26 and was maintained until September 24 when the price dropped to $1.15; it remained at $1.15 until the last week of the year when it dropped to $1. The London price was 5s. at the beginning of the year, rose to 6s. late in March, and held at this quotation for some weeks. The rise to 6s. 4d. in October, when the domestic price had fallen sharply, was occasioned by the abandonment of the gold standard by Great Britain on September 21, 1931. The London price at the end of the year was equivalent to 94 cents a pound in United States currency.

SELENIUM

Three companies reported an output of 185,307 pounds of selenium in 1931, compared with 454,769 pounds in 1930, a decline of 59 per cent. Sales, however, were larger in 1931 than in 1930, totaling 292,234 pounds as compared with 278,309 pounds, an increase of 5 per cent. The large stocks on hand at the end of 1930 were drawn upon during 1931. Sales of selenium during the past 5 years are shown in the following table.

Selenium sold by producers and in stock at producers' plants in the United States, 1927–1931

Year	Sales			Stock at end of year (pounds)
	Pounds	Value		
		Total	Average	
1927	284,508	$491,996	$1.73	158,494
1928	362,697	607,382	1.67	214,836
1929	344,288	568,265	1.65	391,033
1930	278,309	454,911	1.63	567,493
1931	292,234	386,255	1.32	[1] 457,911

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[1] Includes a small quantity of tellurium.

Selenium and selenium salts imported for consumption in the United States, 1922–1931

Year	Pounds	Value	Year	Pounds	Value
1922	1,652	$2,530	1927	15,286	$28,199
1923	940	1,653	1928	18,622	33,998
1924	300	606	1929	3,592	5,971
1925	5,807	10,582	1930	680	988
1926	18,885	34,680	1931	2,189	2,777

According to Metal and Mineral Markets, quotations for selenium (black, powdered, amorphous, 99.5 per cent pure) at New York were $1.80 to $2 a pound (depending upon quantity) throughout the year. The London prices, where given, were 7s. 8d. to 7s. 9d. throughout the year.

The following notes on the consumption of selenium and tellurium are quoted from Metal and Mineral Markets for May 26, 1932.

Consumption of selenium in the United States has shown a steady increase during the last 10 years, according to a paper by S. Skowronski and M. A. Mosher, presented at the sixty-first general meeting of American Electrochemical Society, held recently in Baltimore, Md. In 1921, total sales aggregated 55,978 pounds, valued at $89,148; in 1930, the corresponding figures were 278,309 pounds and $454,911. This consumption, however, is still far below potential refinery production.

The chief consumer of selenium is the glass industry, where it is employed as a decolorizer and in the manufacture of ruby glass. In the ceramic industry selenium is used in conjunction with cadmium sulphide to obtain various red and orange shades of enamel. In later years it has also been used successfully in rubber compounding, as it increases the resistance of the rubber to abrasion by 50 to 80 per cent. Wire cable sheathed with selenium rubber is on the market and is advertised as such. Other uses for selenium rubber, such as in tires and in mechanical rubber goods, are still in the experimental stage. Selenium acts as a flame-proofing material in cable, not only when applied to the surface but also when compounded with rubber to the extent of 8 per cent. Some selenium is now used in the dye industry for the manufacture of special dyes.

With the development of television, selenium cells have been improved much, and the lack of uniformity and high inertia of the earlier types of cells have been corrected. Several makes of cells now on the market are guaranteed to give satisfactory service. For the glass, rubber, ceramic, and dye industry, selenium pulverized to pass a 100-mesh screen and analyzing not less than 99 per cent Se is usually specified. For production of cells the vitreous selenium, cast either in stick or cake form, is recommended.

G. D. Bengough and L. Whitby in an advance paper to The Institute of Metals report that a process has been developed for the production of a film of selenium on several light magnesium alloys. This film, which imparts appreciable resistance to the corrosive action of sea-water spray, is normally produced by immersion for a few minutes in a bath containing selenious acid; it may also be obtained by rubbing the alloy with a spongy material dipped in the bath. To a limited degree this film has the property of "self-healing," especially when immersed in stagnant sea water. This process may prove of importance for protection of magnesium-rich alloys, particularly those used in aircraft construction.

The commercial use of tellurium, although disappointingly small, shows a large increase in 1930, with a total of 4,717 pounds, valued at $7,996, compared with 1,309 pounds in 1929. This increase was mainly a result of large-scale experimentation with tellurium as a rubber-compounding material. Di-ethyl telluride was one of the first antiknock compounds to be discovered but was later replaced by tetra-ethyl lead; metallic selenium also found application as crystal detector in the early days of radio. Electroplaters are using a solution of tellurium chloride as a dip for silver ware when a dark finish is wanted.

Tellurium is sold in 1, 5, or 10 pound cakes analyzing 98 to 99 per cent Te, with selenium as the chief impurity; it is also furnished in powdered form if desired. Two grades of tellurium oxide are on the market, one chemically pure and the other containing small percentages of selenium and sodium salts.

The fact that tellurium can be electroplated should be of interest to electrochemists. Remarkable specimens, about half an inch thick and unusually smooth, plated on lead starting sheets, were exhibited in 1928 by Prof. Frank Mathers. He recommended an electrolyte of hydrofluoric and sulphuric acid, at room temperature, a current density of 1.6 amperes per square decimeter, and a voltage about 1; anodes were tellurium and cathodes of lead. Carbon or graphite anodes also work well. Bright deposits have been obtained that do not tarnish readily, but the brittleness of the metal makes its use as an electroplating material of doubtful value.

The principal source of selenium and tellurium is the anode slime produced in the electrolytic copper refineries. Both are recovered in the process of extracting the precious metals from this slime. The Arizona blister copper as a rule runs high in selenium, up to 0.15 per cent. Montana blister is relatively low in selenium and high in tellurium, averaging about 0.1 per cent of the latter element.

TELLURIUM

Only two companies reported a production of tellurium in 1931, and the Bureau of Mines is not at liberty to publish the amount. In 1930 three producers reported an output of 14,095 pounds and sales of 4,717 pounds, valued at $7,996. The quoted price for tellurium at New York was $2 a pound throughout 1931. London prices were given as 9s. to 9s. 6d. a pound.

Notes on the consumption of tellurium are given on page 15.

BAUXITE AND ALUMINUM[1]

By C. E. Julihn[2]

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INTRODUCTION

In 1931 world production of aluminum declined 17 per cent, but the decline in consumption was more pronounced than that in production, as stocks increased substantially. It is of interest, however, that the aluminum output in 1931—225,681 metric tons[3]—exceeded the 219,833 tons attained for the first time in 1927.

The European aluminum cartel was reorganized to include the industry in Canada, but the United States did not join the cartel.

Aluminum production in the United States declined more than 22 per cent—from 229,000,000 pounds in 1930 to 178,000,000 pounds in 1931. Imports of aluminum decreased 39 per cent in value; exports decreased 60 per cent. The quoted price of the metal (No. 1 virgin 98–99 per cent) remained fixed throughout the year at 22.9 cents a pound.

WORLD PRODUCTION OF BAUXITE AND ALUMINUM

As yet definite figures on the production of bauxite throughout the world in 1931 are not available. In 1930 world production, as compiled by the Bureau of Mines from official reports, amounted to 1,625,000 metric tons, compared with 2,149,000 tons in 1929. The production in 1930 includes 900,000 tons (more than 55 per cent of the total) from Europe, 386,000 tons (nearly 24 per cent) from South America, and 336,000 tons (21 per cent) from North America. Production in 1930 from Asia and Australia amounted to less than 0.2 per cent of the total.

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[1] Work on manuscript completed June, 1932.

[2] Statistics on domestic production prepared by H. W. Davis and figures on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

[3] American Bureau of Metal Statistics, Yearbook, 1931: New York, 1932, p. 105.

World production of bauxite, 1927–1931, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1927	1928	1929	1930	1931
Australia:					
New South Wales	------	------	------	------	199
Victoria	936	196	555	(1)	(1)
British Guiana [2]	163, 454	168, 077	188, 123	121, 536	(1)
France	654, 800	636, 000	666, 300	608, 445	347, 947
Germany	------	6, 860	7, 256	------	(1)
Greece	4, 300	300	6, 280	1, 317	(1)
Hungary	339, 464	395, 974	389, 152	31, 696	(1)
India, British	4, 379	14, 902	9, 189	2, 554	(1)
Italy	95, 300	162, 229	192, 774	161, 187	67, 369
Rumania	1, 706	653	926	678	(1)
Spain	------	181	975	323	(1)
Surinam (Dutch Guiana)	184, 203	213, 869	209, 998	264, 556	173, 154
United Kingdom: Northern Ireland	5, 394	2, 322	2, 359	2, 070	(1)
United States	326, 091	381, 452	371, 648	335, 918	199, 039
Yugoslavia	100, 327	49, 264	103, 366	94, 700	(1)
	1, 880, 000	2, 032, 000	2, 149, 000	1, 625, 000	(1)

[1] Data not available.

[2] Exports.

Aluminum was produced only in Europe and North America, a little more metal being furnished by the former than by the latter. North America contributed 110,000 metric tons and Europe 115,681 tons, a total of 225,681 tons in 1931 compared with 272,415 tons in 1930 and 281,998 tons in 1929.[4]

RANK OF COUNTRIES IN PRODUCTION OF ALUMINUM AND BAUXITE

If aluminum and bauxite production is considered by countries the United States leads all others in production of the metal and France in production of bauxite. Six countries supplied about 87 per cent of the total aluminum produced in the world in 1931; in order of output they are the United States, Canada, Germany, France, Norway, and Switzerland. Three countries—France, the United States, and Dutch Guiana—supplied 74 per cent of the total bauxite produced in 1930; four other countries—Italy, British Guiana, Yugoslavia, and Hungary—supplied 25 per cent. Hungary dropped from second place in bauxite production in 1929 to seventh place in 1930. Of the 7 chief producers of bauxite and 6 chief producers of aluminum only 2 countries—the United States and France—appear in both groups, as the following table shows:

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[4] See footnote 3.

Rank of countries in production of aluminum in 1931 and bauxite in 1930

Aluminum			Bauxite		
Rank	Country	Production in 1931 (per cent of world total)	Rank	Country	Production in 1930 (per cent of world total)
1	United States	35.67	1	France	37.44
2	Canada	13.07	2	United States	20.67
3	Germany	11.08	3	Dutch Guiana	16.28
4	France	10.63	4	Italy	9.92
5	Norway	9.49	5	British Guiana	7.48
6	Switzerland	7.09	6	Yugoslavia	5.83
	Other countries (England, Italy, Austria, and Spain)	12.97	7	Hungary	1.95
				Other countries	.43
		100.00			100.00

BAUXITE

DOMESTIC PRODUCTION—IMPORTS AND EXPORTS

In 1931 the bauxite output of the United States was 195,895 long tons, valued at $1,140,629, compared with 330,612 tons, valued at $1,928,297, in 1930. The decreases in quantity and total value amount to 41 per cent. The decrease in output was accompanied by a decrease of 87,054 tons in net imports, compounded of 16,134 tons decrease in exports and 103,188 tons decrease in imports. Imports of bauxite aggregated 306,490 long tons, valued at $1,495,577, in 1931, compared with 409,678 tons, valued at $1,995,941, in 1930, a decrease of 25 per cent in quantity. Exports in 1931 amounted to 88,370 long tons, valued at $3,309,208, compared with 104,504 tons, valued at $3,776,774, in 1930, a decrease of 15 per cent in quantity. The net imports in 1931 thus amounted to 218,120 tons, compared with 305,174 tons in 1930. The resulting total supply of bauxite in the United States in 1931 was 414,015 tons, compared with 635,786 tons in 1930; the net decrease in supply was 221,771 tons or 35 per cent.

The higher unit value of exports, compared with imports, is due to the fact that they consist chiefly of so-called concentrates, which are purified alumina extracted from bauxite for use in the electrical reduction of aluminum.

Bauxite produced in the United States, 1922–1931

Year	Georgia, Alabama, and Tennessee [1]		Arkansas		Total	
	Long tons	Value f. o. b. mine	Long tons	Value f. o. b. mine	Long tons	Value f. o. b. mine
1922	42,810	$329,440	266,790	$1,682,890	309,600	$2,012,330
1923	28,810	176,030	493,880	2,980,580	522,690	3,156,610
1924	19,940	156,990	327,630	1,981,000	347,570	2,137,990
1925	20,220	109,800	296,320	1,878,450	316,540	1,988,250
1926	20,680	116,650	371,570	2,298,550	392,250	2,415,200
1927	17,110	95,920	303,830	1,892,860	320,940	1,988,780
1928	14,190	80,668	361,236	2,193,230	375,426	2,273,898
1929	14,723	84,480	351,054	2,181,158	365,777	2,265,638
1930	15,339	104,908	315,273	1,823,389	330,612	1,928,297
1931	9,198	59,179	186,697	1,081,450	195,895	1,140,629

[1] No production from Alabama in 1924, 1925, and 1926, and none from Tennessee in 1927, 1929, 1930, and 1931.

Bauxite imported into and exported from the United States, 1922–1931

Year	Imports for consumption		Exports (including bauxite concentrates)		Year	Imports for consumption		Exports (including bauxite concentrates)	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1922	23, 656	$93, 805	19, 617	$961, 208	1927	356, 580	$1, 572, 236	121, 858	$7, 800, 491
1923	119, 020	593, 882	78, 560	3, 380, 486	1928	350, 111	1, 534, 498	112, 984	5, 210, 912
1924	201, 974	909, 493	77, 065	3, 979, 832	1929	380, 812	1, 753, 840	133, 551	3, 926, 283
1925	353, 696	1, 549, 120	78, 633	4, 134, 455	1930	409, 678	1, 995, 941	104, 504	3, 776, 774
1926	281, 644	1, 187, 497	87, 770	4, 741, 260	1931	306, 490	1, 495, 577	88, 370	3, 309, 208

Bauxite was produced in Alabama in 1931 from the Eufaula and "Lennig" mines in Barbour County. Shipments were 53 per cent less than in 1930. All of the ore shipped was taken by the chemical industry.

Bauxite was produced in Georgia in 1931 at the Hatton and Easterlin mines in Sumter County. Shipments were 27 per cent less than in 1930, and this ore was also taken by the chemical industry.

Bauxite was produced in Arkansas in 1931 at four mines—the England and Dixie No. 2 mines in Pulaski County and the Bauxite and Superior mines in Saline County. Total shipments from Arkansas amounted to 186,697 long tons, a decrease of 41 per cent from 1930. The main production originated in the Saline County field, where shipments decreased 42 per cent. The mines in Pulaski County shipped 35 per cent less in 1931 than in 1930. The shipments from Arkansas were mainly for use in the aluminum industry, followed in order by the abrasive, chemical, and refractory industries.

TOTAL BAUXITE PRODUCTION OF THE UNITED STATES

The first bauxite produced in the United States was obtained in 1889 from deposits in the north Georgia field, and in 1891 bauxite was first produced from the Alabama deposits. Practically all the bauxite mined in the United States until 1899 came from these two States. In 1896 the first shipments were made from Arkansas deposits, but it was not until 1900 that their influence was felt. In 1907 bauxite from the Tennessee deposits was first shipped. The total production of bauxite recorded in Mineral Resources from 1889 to 1931, inclusive, is 8,026,294 long tons.

PRICE

As the largest consumers of bauxite in the United States are also the chief producers and as consumers who do not own deposits usually contract for their supplies for considerable periods to assure an adequate supply, only a small market exists for new or sporadic production. The producers of domestic bauxite reported sales during 1931 at prices ranging from $4.90 to $12.60 a long ton. The average for Arkansas bauxite was $5.79 a ton, for the Alabama and Georgia product $6.43, and for the United States $5.82. Consumers, on the other hand, report prices for domestic bauxite that average considerably more. The price at the consuming plant varies with the distance from mines, and transportation charges are the chief element in the difference in cost reported.

The quoted prices [5] for bauxite were as follows: Domestic: Chemical ore, crushed and dried, 55 to 58 per cent Al_2O_3 and 1.5 to 2.5 per cent Fe_2O_3, $6.50 to $8.25 a long ton f. o. b. Alabama and Arkansas mines. Foreign: Dalmatian bauxite, 50 to 55 per cent Al_2O_3 and 1 to 3 per cent SiO_2, $4.50 to $6.55; Istrian, 54 to 57 per cent Al_2O_3 and 3 to 5 per cent SiO_2, $5.50 to $7; and French, 56 to 59 per cent Al_2O_3 and 2 to 4 per cent SiO_2, $6 to $8 a metric ton c. i. f. Atlantic ports.

Under the tariff act of 1930 crude bauxite is dutiable at the rate of $1 a ton, and alumina hydrate or refined bauxite at one-half cent a pound. (See par. 6, Schedule 1, and par. 207, Schedule 2.)

MARKET

The principal market for bauxite is east of the Mississippi River; it is sold chiefly to the manufacturers of aluminum, abrasives, commercial chemicals, and refractories. However, the manufacturers of alumina cements are supplied largely by imported bauxite. High-alumina (diaspore) clays produced in Missouri are now used in the manufacture of refractories and are sold according to their alumina content; three grades, containing 55, 65, and 70 per cent of alumina (Al_2O_3), are regularly handled. Information on production will be found in the Mineral Resources report on Clay.

Some makers of refractories and of aluminum chemicals are using increasing quantities of clay as a crude material in place of bauxite.

Domestic bauxite was reported sold in 1931 to the consuming industries in the table that follows, which shows that the total quantity sold decreased 41 per cent. In comparison with 1930, sales of domestic bauxite to the aluminum industry decreased 54 per cent, those to manufacturers of chemicals 14 per cent, and those to makers of artificial abrasives 35 per cent.

Domestic bauxite sold by producers to industries in the United States, 1922–1931, in long tons

Year	Aluminum	Chemical	Abrasive [1]	Cement and refractory [1]	Total	Year	Aluminum	Chemical	Abrasive [1]	Cement and refractory [1]	Total
1922	211, 560	78, 540	19, 270	230	309, 600	1927	186, 490	62, 410	71, 790	250	320, 940
1923	380, 520	68, 870	72, 830	470	522, 690	1928	218, 398	83, 992	72, 931	105	375, 426
1924	225, 780	54, 870	66, 400	520	347, 570	1929	172, 807	86, 419	99, 925	6, 626	365, 777
1925	173, 040	67, 420	73, 720	260	314, 440	1930	179, 869	67, 690	82, 116	937	330, 612
1926	241, 850	77, 960	72, 710	230	392, 250	1931	83, 340	58, 424	53, 631	500	195, 895

[1] Small quantity of bauxite sold to makers of refractories probably included under "Abrasive."

Value of aluminum and aluminum salts made from bauxite in the United States, 1922–1931

Year	New aluminum	Aluminum salts	Year	New aluminum	Aluminum salts
1922	$13, 622, 000	$8, 813, 000	1927	$39, 266, 000	$14, 288, 430
1923	28, 305, 000	8, 987, 400	1928	47, 899, 000	13, 990, 264
1924	37, 607, 000	9, 301, 400	1929	51, 864, 000	11, 677, 728
1925	36, 430, 000	13, 155, 790	1930	50, 961, 000	10, 245, 063
1926	37, 583, 000	13, 202, 010	1931	37, 284, 000	8, 736, 030

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[5] Metal and Mineral Markets, vol. 2, 1931, weekly price quotations.

BAUXITE PRODUCERS IN THE UNITED STATES IN 1931

Dixie Bauxite Co., Sweet Home, Ark.
Benjamin Easterlin, Americus, Ga.
General Abrasive Co. (Inc.), Niagara Falls, N. Y.
Kalbfleisch Corporation, 535 Fifth Avenue, New York, N. Y.
Charles Lennig & Co. (Inc.), 222 West Washington Square, Philadelphia, Pa.
Republic Mining & Manufacturing Co., 230 Park Avenue, New York, N. Y.

CONSUMERS OF BAUXITE IN THE UNITED STATES IN 1931

Alcoa Ore Co., East St. Louis, Ill.
Atlas Lumnite Cement Co., 208 South La Salle Street, Chicago, Ill.
Birmingham Water Works Co., Birmingham, Ala.
Board of Public Utilities, Kansas City, Kans.
Bureau of Water Supply, Baltimore, Md.
Calumet Chemical Co., Joliet, Ill.
The Carborundum Co., Niagara Falls, N. Y.
City of Columbus Purification Works, Columbus, Ohio.
Columbus Water Works, Columbus, Ga.
Dalecarlia Filter Plant, Washington, D. C.
Exolon Co., Blasdell, N. Y.
Federal Abrasives Co., Anniston, Ala.
General Abrasive Co. (Inc.), Niagara Falls, N. Y.
General Chemical Co., 40 Rector Street, New York, N. Y.
General Refractories Co., 106 South Sixteenth Street, Philadelphia, Pa.
Grasselli Chemical Co., Cleveland, Ohio.
Gulf Refining Co., Frick Building Annex, Pittsburgh, Pa.
Harbison-Walker Refractories Co., Pittsburgh, Pa.
William F. Jobbins (Inc.), Aurora, Ill.
Kalbfleisch Corporation, 535 Fifth Avenue, New York, N. Y.
Laclede-Christy Clay Products Co., St. Louis, Mo.
Charles Lennig & Co. (Inc.), 222 West Washington Square, Philadelphia, Pa.
Louisiana Chemical Co. (Inc.), Bastrop, La.
Massillon Stone & Fire Brick Co., Massillon, Ohio.
Merrimac Chemical Co., 148 State Street, Boston, Mass.
Metropolitan Utilities District, Omaha, Nebr.
Norton Co., Worcester, Mass. (also Niagara Falls, N. Y.).
Paper Makers Chemical Corporation, Easton, Pa.
Passaic Valley Water Commission, 158 Ellison Street, Paterson, N. J.
Pennsylvania Salt Manufacturing Co., Widener Building, Philadelphia, Pa.
Sacramento Filtration Works, Sacramento, Calif.
Stauffer Chemical Co., 624 California Street, San Francisco, Calif.
Vanadium Corporation of America, Bridgeville, Pa.
Water Department of Kansas City, Kansas City, Mo.
Welch Chemical Co., 8 East Long Street, Columbus, Ohio.

ALUMINUM

DOMESTIC PRODUCTION—IMPORTS AND EXPORTS

New aluminum produced in the United States in 1931 amounted to 177,544,000 pounds (88,772 short tons), valued at $37,284,000, representing decreases of 22 per cent in quantity and 27 per cent in total value compared with 1930. According to statistics collected by J. P. Dunlop, of the Bureau of Mines, 30,300 short tons of secondary aluminum were recovered in 1931—15,200 tons as metal and 15,100 tons as the aluminum content of casting alloys. Thus, in 1931 the combined domestic production of new aluminum and of secondary aluminum recovered as metal and in alloys amounted to 119,072 tons, 75 per cent of the total being new metal and 25 per cent secondary or recovered material.

Aluminum produced in the United States, 1922–1931

Year	Primary metal		Secondary metal		Year	Primary metal		Secondary metal	
	Pounds	Value	Pounds	Value [1]		Pounds	Value	Pounds	Value [1]
1922	74, 000, 000	$13, 622, 000	32, 580, 000	$6, 085, 900	1927	160, 000, 000	$39, 266, 000	92, 400, 000	$23,469,600
1923	129, 000, 000	28, 305, 000	42, 600, 000	10, 824, 600	1928	210, 000, 000	47, 899, 000	95, 600, 000	22, 848, 400
1924	150, 000, 000	37, 607, 000	54, 000, 000	14, 596, 200	1929	225, 000, 000	51, 864, 000	96, 800, 000	23, 135, 200
1925	140, 000, 000	36, 430, 000	88, 000, 000	24, 816, 000	1930	229, 035, 000	50, 961, 000	77, 200, 000	17, 177, 000
1926	145, 000, 000	37, 583, 000	88, 400, 000	23, 868, 000	1931	177, 544, 000	37, 284, 000	60, 600, 000	12, 726, 000

[1] 1922–1929: Value of secondary aluminum based on average price at New York as given by American Metal Market; 1930–31: Based on average price as reported to Bureau of Mines.

Aluminum imports decreased 39 per cent in total value—from $5,285,584 in 1930 to $3,210,745 in 1931; exports decreased 60 per cent—from $7,121,854 in 1930 to $2,854,745 in 1931.

Imports of aluminum metal, scrap, alloy, etc., decreased 42 per cent in quantity in 1931 compared with 1930; imports of plates, sheets, bars, circles, disks, etc., increased 248 per cent in quantity; imports of hollow ware increased 14 per cent in quantity and 6 per cent in value; and imports of aluminum powders and foil increased 38 per cent in quantity.

Aluminum imported for consumption in the United States, 1930 and 1931, by classes

Class	1930		1931	
	Pounds	Value	Pounds	Value
Crude and semicrude:				
Crude form, scrap, alloy, etc	25, 412, 742	$4, 674, 815	14, 664, 195	$2, 497, 314
Plates, sheets, bars, rods, circles, squares, etc	48, 437	14, 706	168, 612	42, 442
	25, 461, 179	4, 689, 521	14, 832, 807	2, 539, 756
Manufactures:				
Leaf (5½ by 5½ inches)	(1)	36, 905	(1)	59, 049
Bronze powder and powdered foil [2]	467, 146	155, 258	591, 684	175, 981
Foil less than 0.006 inch thick	740, 918	277, 390	1, 070, 119	322, 865
Table, kitchen, and hospital utensils and other similar hollow ware	102, 829	57, 961	117, 649	61, 711
Other manufactures	(3)	68, 549	(3)	51, 383
	------------	596, 063	------------	670, 989
Grand total	------------	5, 285, 584	------------	3, 210, 745

[1] 1930: 27,154,316 leaves; 1931: 39,699,868 leaves; equivalent in pounds not recorded.
[2] Import classification beginning June 18, 1930; prior to change in tariff classification read "Powder, powdered foil."
[3] Quantity not recorded.

Aluminum imported for consumption in the United States, 1922–1931

Year	Crude and semicrude [1]		Manufactures of [2]	Total value	Year	Crude and semicrude [1]		Manufactures of [2]	Total value
	Pounds	Value				Pounds	Value		
1922	43, 891, 933	$8, 286, 819	$1, 408, 193	$9, 695, 012	1927	62, 575, 222	$13, 316, 986	$884, 992	$14, 201, 978
1923	42, 476, 789	8, 316, 816	425, 747	8, 742, 563	1928	38, 847, 007	8, 057, 107	816, 368	8, 873, 475
1924	31, 809, 941	6, 859, 785	285, 251	7, 145, 036	1929	50, 880, 823	9, 934, 723	925, 286	10, 860, 009
1925	41, 997, 178	9, 805, 645	301, 122	10, 106, 767	1930	25, 461, 179	4, 689, 521	596, 063	5, 285, 584
1926	71, 391, 717	16, 421, 905	357, 472	16, 779, 377	1931	14, 832, 807	2, 539, 756	670, 989	3, 210, 745

[1] Includes crude aluminum, plates, sheets, wire, etc.
[2] Includes aluminum leaf, kitchen utensils, and all other manufactures of aluminum.

Exports of crude and semicrude aluminum decreased 73 per cent in quantity in 1931 compared with 1930; exports of tubes, moldings, castings, and other shapes decreased 31 per cent in quantity.

Domestic aluminum exported from the United States, 1930 and 1931, by classes

Class	1930		1931	
	Pounds	Value	Pounds	Value
Crude and semicrude:				
Ingots, scrap, and alloys	607,608	$84,278	1,510,688	$132,484
Plates, sheets, bars, strips, and rods	16,721,903	3,831,304	3,190,190	853,386
	17,329,511	3,915,582	4,700,878	985,870
Manufactures:				
Tubes, moldings, castings, and other shapes	1,864,308	598,949	1,292,400	551,606
Table, kitchen, and hospital utensils	(1)	560,267	(1)	386,744
Other manufactures of aluminum	(1)	2,047,056	(1)	930,525
	(1)	3,206,272	(1)	1,868,875
Grand total	(1)	7,121,854	(1)	2,854,745

[1] Quantity not recorded for table, kitchen, and hospital utensils and other manufactures.

Aluminum and manufactures of aluminum exported from the United States, 1922–1931

Year	Crude and semicrude[1]		Manufactures	Total value	Year	Crude and semicrude[1]		Manufactures	Total value
	Pounds	Value				Pounds	Value		
1922	4,347,020	$1,127,460	[2] $1,708.656	$2,836,116	1927	14,522,560	$3,478,649	[3] $2,828,772	$6,307,421
1923	5,539,671	1,517,562	[2] 2,053,977	3,571,539	1928	15,728,281	3,758,728	[3] 3,132,762	6,891,490
1924	6,343,512	1,632,315	[2] 2,540,075	4,172,390	1929	17,032,117	4,149.539	[3] 3,821,546	7,971,085
1925	12,642,034	3,365,815	[2] 2,691,256	6,057,071	1930	17,329,511	3,915,582	[3] 3,206,272	7,121,854
1926	7,634,171	2,135,087	[3] 2,317,216	4,452,303	1931	4,700,878	985,870	[3] 1,868.875	2,854,745

[1] Includes ingots, metal and alloys, plates and sheets, etc.

[2] Represents value of 4,544,949 pounds in 1922, 5,402,034 pounds in 1923, 6,783,240 pounds in 1924, and 6,463,192 pounds in 1925 of tubes, moldings, castings, and other shapes, table, kitchen, or hospital utensils, and other manufactures.

[3] Tubes, moldings, castings, and other shapes exported amounted to 2,115,274 pounds in 1926, 1,529,615 pounds in 1927, 1,003,957 pounds in 1928, 2,466,508 pounds in 1929, 1,864,308 pounds in 1930, and 1,292,400 pounds in 1931; figures for quantity of table, kitchen, or hospital utensils and other manufactures exported are not recorded.

From the preceding tables of imports and exports in 1931 it appears that the total imports for which the weights are recorded amounted to 8,306 short tons and the total exports to 2,997 tons. The excess of imports over exports thus accounted for amounts to 5,309 tons, indicating an approximate total supply of 94,081 tons of aluminum, other than domestic secondary, for domestic consumption.

PRICE

According to the Engineering and Mining Journal, the domestic price of new aluminum ingot 99 per cent pure was maintained at 23.3 cents a pound throughout the year. The open-market quotation at New York for virgin metal 98 to 99 per cent pure was held at 22.9 cents a pound.

USES AND CONSUMPTION OF ALUMINUM

Many important uses for aluminum are based upon its physical and chemical properties, of which light weight is of chief importance. Weight was a factor in the early use of aluminum for kitchen utensils and in its subsequent use in automobiles, airplanes, airships, and other means of transportation. Aluminum competes with copper as an electrical conductor; it is an important adjunct to the metallurgy of steel. Lately it has become important as a light structural material made strong by alloying and heat treatment. It is marketed in die castings; sand castings; permanent structural shapes; foil; paints; powder; round, square, flat, and hexagonal wire; rivets; bolts; nuts; screen; perforated sheets; bottle caps; drums; barrels; collapsible tubes; tanks and tank cars; pans; shingles; corrugated sheets; and many other forms.

In 1931 there was a pronounced decline in consumption which was partly offset by promising developments in certain uses in which declining consumption was less marked. Thus development in adapting the metal for architectural purposes continued. Aluminum sheet and insulating material have been used in wall construction. Such walls are said to have an insulating value more than ten times that of an equal thickness of much heavier material, and their average weight is only 10 pounds a square foot.

The resistance of aluminum to acid corrosion by the atmosphere of cities encourages its use as roofing and as an ornamental metal on the exterior of important buildings. The same property of aluminum led to the extension of its use in the dairy industry during the past year. Aluminum in milk-tank trucks makes unnecessary an inner liner for tanks, decreases the dead load, and increases the pay load. Its use in milk cans is becoming more extensive; milk-bottle caps of aluminum foil that seal the bottle have been introduced. Aluminum foil is also used for wrapping butter and cheese.

In transportation aluminum is gaining wider application. Although its consumption in pleasure cars declined during the past year, four manufacturers are understood to have reduced materially the weight of chassis through use of aluminum. The tonnage of aluminum employed in trucks and busses has continued to increase. The metal makes possible the use of dump trucks and trailer units of large capacity. Considerable aluminum is used in the production of electric street cars, and an all-aluminum Pullman car is being built.

A recent trial of duralumin skips and cages in three mines of the Rand in South Africa indicates economies resulting from use of this lighter metal.[6] It is stated that, although the initial cost of duralumin equipment is more than double that of all-steel equipment, one of the skips has a capacity of 7 tons, instead of 6 tons, as do steel skips, while the gross load on the rope is 445 pounds less. A saving in current of £1,000 per annum has been shown. For a given tonnage hoisting time is reduced nearly 20 per cent. No noticeable corrosion is recorded in skips that have been in service 12 months, although acid mine water corrodes steel cages.

The consumption of aluminum in aircraft is said to have declined sharply, but experimentation in this field continued. The welding of aluminum is being subjected to intensive research with especial reference to the requirements of aircraft.

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[6] The Mining and Industrial Magazine of Southern Africa, Lighter Metal for Skips and Cages: Apr. 27, 932, vol. 14, No. 5, p. 147.

Electrical conductors of a new type are being made of aluminum channels arranged face to face to form a hollow square in cross section. This type is more rigid and weighs much less than a flat bus bar.

Progress has been made in anodic coating of aluminum with a film of oxide that increases resistance to abrasion and corrosion. It also serves purposes of decoration, and as the oxide coating absorbs dyes the metal may be colored. This has already proved useful for packaging, and it is being applied to interior decoration.

In the past year there is said to have been extension in the use of aluminum paint for mill priming lumber and semifabricated products, such as sash and frames. The paint includes aluminum-bronze powder as a pigment.

A new alloy consisting of aluminum with 1 per cent each of manganese and magnesium is reported. Its field is expected to be between that of heat-treated strong alloys and that of simple wrought alloys.

Consumption of aluminum foil has increased. The following quotation [7] is of interest:

> In Germany * * * the annual production (of aluminum foil) has reached almost 5,000 tons * * *.
>
> Among new applications, the use of crumpled foil as an insulating material is probably the most important. Extreme lightness—barely three ounces per cubic foot; high thermal efficiency; low heat storage; resistance to corrosion by fumes and moisture; and freedom from fire hazards are among the advantages gained; the material is easily applied, is clean, and vermin proof. Limited area of contact and the thinness of the sheets minimize conductance of heat through the foil itself. This material is rapidly finding wide application, in refrigerator systems on ships, railroad cars, and trucks, cases in which the light weight makes possible an important increase in pay load. Other uses are in household refrigerators, food industries, high-pressure steam installations, and home insulations.
>
> Use of aluminum foil in printing is another new application demonstrated recently on the annual Leipzig Fair, the show place of German industrial and commercial progress. A printing plate, cheaper than the usual paper matrix, may be produced by writing on foil, either by hand or by machine. As many prints as desired, in several colors, may be reproduced from such a plate. Drawings may be made directly on the foil or by tracing from the original, and impressions from line cuts and type are also easily reproduced. The plates are waterproof, light proof, and true to type; they may be kept indefinitely without deterioration.
>
> Models and statuary made from kneaded foil, for show cases and exhibits, produce most striking effects. Such applications as these, introducing the metal into entirely new fields, and involving no destructive competition with other metals, are encouraging signs. Smoothing out the curve of depression, they also offer hope of more speedy recovery when business again turns upward.

ALUMINUM SALTS

Manufacturers of aluminum salts reported a consumption of 112,102 long tons of bauxite in 1931, with an average value of $11.55 a ton at the plant, compared with 125,382 tons in 1930, with an average value of $12.06 a ton. Of the bauxite consumed in 1931, 58,553 tons were domestic and 53,549 tons imported bauxite. An unrecorded quantity of high-alumina clay, 2,818 short tons of alumina hydrate, and some aluminum sulphate were also used in the preparation of aluminum salts. These figures do not include the bauxite made into alumina and sodium aluminate as a preliminary step in the manufacture of aluminum. Neither do the figures in the following table include the alumina and sodium aluminate made as a preliminary step in the manufacture of aluminum.

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[7] Metal and Mineral Markets, Extending New Outlets for Aluminum Foil: Vol. 3, No. 21, May 26, 1932, p. 9.

Aluminum salts produced in the United States, 1930 and 1931

Salt	1930				1931			
	Number of producers reporting	Short tons	Value		Number of producers reporting	Short tons	Value	
			Total	Average			Total	Average
Alum:								
Ammonia	5	4,076	$228,986	$56	5	4,668	$251,066	$54
Potash	3	1,923	104,818	55	3	2,086	111,168	53
Sodium-aluminum sulphate	3	14,787	802,981	54	3	15,907	905,184	57
Aluminum chloride:								
Liquid	3	3,288	90,731	28	4	1,588	60,685	38
Crystal	3	583	53,363	92	2	5,533	560,175	101
Anhydrous	3	11,664	1,208,091	104	3			
Aluminum sulphate:								
Commercial—								
General	10	305,059	6,649,066	22	10	291,875	5,951,392	20
Municipal	9	10,300	172,671	17	10	11,509	193,450	17
Iron-free	7	18,177	642,247	35	7	15,108	483,060	32
Other aluminum salts and hydrate	[1] 4	3,194	292,109		[1] 4	2,797	219,850	
		373,051	10,245,063			351,071	8,736,030	

[1] 1930: 3 producers of alumina and 1 producer of sodium aluminate; 1931: 2 producers each of alumina and sodium aluminate.

Aluminum salts produced in, imported into, and exported from the United States, 1922–1931

Year	Domestic production		Imports		Exports (aluminum sulphate) [1]	
	Short tons	Value	Short tons	Value	Short tons	Value
1922	281,480	$8,812,987	2,889	$116,971	13,225	$388,447
1923	289,904	8,987,421	2,318	120,663	17,805	505,732
1924	302,190	9,301,410	2,523	113,075	16,012	407,749
1925	335,480	13,155,790	3,205	140,518	20,756	505,537
1926	373,695	13,202,010	2,937	140,994	22,031	521,123
1927	378,770	14,288,430	1,845	83,288	21,128	491,317
1928	386,905	13,990,264	1,425	68,096	[1] 22,713	[1] 552,342
1929	394,093	11,677,728	1,912	86,411	[1] 26,588	[1] 607,757
1930	373,051	10,245,063	2,058	90,472	[1] 25,255	[1] 573,234
1931	351,071	8,736,030	1,770	82,337	[1] 27,668	[1] 568,490

[1] Also "other aluminum compounds" as follows: 1928, 418 short tons, valued at $85,809; 1929, 275 tons, $65,458; 1930, 1,009 tons, $194,503; 1931, 875 tons, $170,585; not separately classified prior to 1928.

ALUMINOUS ABRASIVES AND REFRACTORIES

The use of aluminous abrasives and high-alumina refractories continued to decline in 1931. Makers of artificial abrasives took 53,631 tons of domestic bauxite in 1931. Makers of refractories took 19,662 short tons of high-alumina (diaspore) clay in 1931.

The aluminous abrasives are used largely in the form of grinding wheels and "sandpaper," in powdered and granulated material.

FOREIGN BAUXITE AND ALUMINUM INDUSTRIES[8]

NORTH AMERICA

CANADA

Canada produced 29,500 metric tons of aluminum in 1931, compared with 34,900 tons in 1930. Exports of aluminum[9] amounted to 9,770 metric tons in 1931, compared with 19,597 tons in 1930. The destination of exports in 1931 was as follows: United Kingdom, 53 per cent; Japan, 17 per cent; United States, 11 per cent; and others, 19 per cent. Imports of aluminum in ingots, bars, rods, etc., in 1931 amounted to 335 metric tons, of which 191 tons came from the United States and 125 tons from the United Kingdom; in 1930, 1,243 metric tons were imported.

Reduction works at Shawinigan Falls and Arvida, in Quebec, are owned by the Aluminum Co. of Canada, a subsidiary of Aluminium (Ltd.). The latter was created in 1928 to take over the Aluminum Co. of Canada together with practically all foreign interests owned by the Aluminum Co. of America. The stock of Aluminium (Ltd.) was distributed as a stock dividend to the stockholders of the Aluminum Co. of America.

The Canadian aluminum industry depends on foreign raw materials. Imports of bauxite and alumina amounted to 86,916 metric tons in 1931 and 96,928 tons in 1930; virtually all of this material came from the United States.

GREENLAND

Greenland, the only source of natural cryolite, exported[10] 36,244 metric tons in 1930, compared with 29,770 tons in 1929 and 25,934 tons in 1928. Official Danish statistics show 27,784 tons imported by Denmark in 1930, as compared with 21,509 tons in 1929 and 16,174 tons in 1928. Imports into the United States in 1930 amounted to 8,448 metric tons. The cryolite sent to Copenhagen in 1930 was refined there and partly reexported to other countries.

SOUTH AMERICA

BRITISH GUIANA

Data for 1931 are not available. Official figures indicate a production from British Guiana in 1930 of 146,996 long tons (149,355 metric tons) of bauxite; exports are officially reported as 119,616 long tons (121,536 metric tons). The production amounted to 220,129 metric tons in 1929, compared with 200,891 tons in 1928 and 192,984 tons in 1927. Exports totaled 188,123 metric tons in 1929, compared with 168,077 tons in 1928 and 163,454 tons in 1927.

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[8] Unless otherwise stated, figures for foreign production of bauxite are those shown in the world table on p. 18, compiled from official reports; those for aluminum are taken from the yearbooks of the American Bureau of Metal Statistics, Imperial Institute, or Metallgesellschaft. Exports and imports are taken from reports of the Imperial Institute, Metallgesellschaft, or Bureau of Foreign and Domestic Commerce, United States Department of Commerce.

[9] Dominion Bureau of Statistics, Trade of Canada: 1931, pp. 207 and 348.

[10] Imperial Institute, Statistical Summary, Ann. Rept. 1928–1930: London, 1931, pp. 15–23.

British Guiana.—*Production and exports of bauxite, 1926–1930, in metric tons*

Year	Production [1]	Exports	Year	Production [1]	Exports
1926	222, 516	189, 101	1929	220, 129	188, 123
1927	192, 984	163, 454	1930	149, 355	121, 536
1928	200, 891	168, 077			

[1] Imperial Institute, Statistical Summary (annual).

The production indicated above probably represents gross weight before drying, as exports are consistently about 17 per cent less.

The principal company operating in British Guiana is the Demerara Bauxite Co. (Ltd.), a subsidiary of Aluminium (Ltd.); but the British & Colonial Bauxite Co. (Ltd.) obtained a lease in 1929 on bauxite deposits up the Demerara River in the vicinity of Christianburg.[11] From the beginning of exploitation in 1915 to the end of 1930, the Demerara company had shipped about 1,280,000 long tons of bauxite. Washers and dryers are now used for beneficiating the ore by removal of silica above 3 per cent. The process yields a 70 per cent recovery.

The bauxite deposits are similar to those of Dutch Guiana, occurring in small hills that rise above the coastal plain 60 to 80 miles from the coast and near the Demerara and Berbice Rivers. The average analysis of shipments is said to be as follows:[12] 61 per cent Al_2O_3; 2.75 per cent SiO_2; 2.5 per cent Fe_2O_3; 2.75 per cent TiO_2; and 31 per cent combined water.

DUTCH GUIANA

Official figures indicate that the production of bauxite in 1931 totaled 173,154 metric tons, compared with 264,556 tons in 1930. Exports totaled 190,596 tons in 1931, compared with 263,015 tons in 1930. The Surinaamsche Bauxite Maatschappij (subsidiary of Aluminum Co. of America) produced 164,712 tons of bauxite in 1931, compared with 257,175 tons in 1930, and exported 179,107 tons in 1931, compared with 253,866 tons in 1930. The Kalbfleisch Corporation of Surinam produced 8,442 tons in 1931, compared with 7,381 tons in 1930, and exported 11,489 tons in 1931, compared with 9,149 tons in 1930.

The ore deposits[13] are near Paramaribo, along the Surinam, Cottica, and Coermotibo Rivers, extending from about 15 to 100 miles from the coast. They range in thickness from 10 to 12 feet in the south to as much as 50 feet in the north.

The ores of Dutch Guiana run about 59 per cent Al_2O_3, 2 per cent SiO_2, 6 per cent Fe_2O_3, 3 per cent TiO_2, and 30 per cent water (combined). They resemble the ores of Arkansas, except that they contain less silica.

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[11] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes: No. 249, June 8, 1929.

[12] Edwards, J. D., Frary, F. C., and Jeffries, Zay, Aluminum and Its Production: 1930, p. 111.

[13] Engineering and Mining Journal, Bauxite Mining in Dutch Guiana: Vol. 128, No. 12, Sept. 21, 1929, pp. 460–463.

EUROPE

THE NEW CARTEL[14]

The European aluminum cartel, formed in 1926 by producers of Germany, France, Great Britain, and Switzerland and subsidiary plants of German and Swiss companies in Italy, Austria, and Spain, has been reorganized as of January 1, 1932. The new organization called the Alliance Aluminum Co., with its office at Basel, includes all former members and the Canadian industry as well. The new cartel thus has achieved a world scope for all practical purposes, because the industry in the United States is chiefly concerned with the domestic market.

It was claimed that the price of £95 per ton, maintained by the cartel for two and one-half years until October, 1931, was too high, in view of the heavy decline in the prices of other metals and the contraction of demand for aluminum. The syndicate, therefore, on January 1, 1932, reduced the fixed price charged by syndicate members to £80 a ton, gold. The original price, established in 1926, was £105; therefore the total reduction amounts to 24 per cent.

The syndicate agreement applies only to raw aluminum, and producers are free to make whatever marketing arrangements and charge whatever prices they wish for semifinished and finished products. German raw aluminum producers complain that the price fixed for the British aluminum industry in the British market, only 95 paper pounds, is considerably below the fixed world price, which is based upon gold pounds. It is pointed out that two shipments of British aluminum have been received recently in Germany and could be marketed there despite the import duty. In the past it has been customary for Germany to export to Great Britain on a large scale.

The aluminum industry of Europe is said to have been affected by competition of other metals, particularly copper, because of low prices. In the electrical industry copper is reported to have regained much of the ground lost to aluminum during the period of high copper prices, and in the kitchen-utensil branch of aluminum manufacture ferro-alloys have offered increased competition. Moreover, other metal alloys have begun to compete in some uses where light weight is the primary consideration. These factors and the accumulation of stocks led to German proposals to regulate international trade in the raw metal, establish export quotas, and fix prices.

AUSTRIA

There are two aluminum-reduction works in Austria—the Aluminium Industrie (Neuhausen) at Lend-Gastein and Elektrizitätswerke Stern und Hafferl, A. G., at Gmunden, Oberösterreich, also known as the Aluminiumwerke Steeg.

Austrian production of aluminum amounted to 3,000 metric tons in 1931, compared with 3,500 tons in 1930, 4,000 tons in 1929, 4,000 tons in 1928, and 4,000 tons in 1927. Exports[15] of aluminum amounted to 3,011 metric tons in 1931, compared with 4,410 tons in 1930, 3,981 tons in 1929, and 4,038 tons in 1928. Imports of aluminum have amounted to less than 1,000 tons annually during the last five years. Exports went largely to Switzerland, Germany, Belgium, and Russia. Austrian reserves of raw materials are not large.

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[14] Commerce Reports, The Aluminum Trade and Industry of Germany: Mar. 14, 1932, p. 623.
[15] Statistik des auswärtigen Handels Oesterreichs, December, 1931, pp. 89–90.

DENMARK

The aluminum industry of Denmark comprises the importation of crude cryolite from Greenland for refining and exportation to other European countries. Imports[16] of crude cryolite amounted to 8,392 metric tons in 1931, compared with 27,785 tons in 1930, 21,398 tons in 1929, 16,174 tons in 1928, and 14,316 tons in 1927. Exports of refined cryolite in 1930 amounted to 15,854 tons, compared with 18,120 tons in 1929, 15,508 tons in 1928, and 12,539 tons in 1927.

Aluminous clays 2 meters thick, averaging 32 to 36 per cent alumina and amounting to several million tons, have been found north of Amundsfjord, Iceland.

FRANCE

Production of bauxite in 1930 amounted to 608,445 metric tons, compared with 666,300 tons in 1929, 636,000 tons in 1928, and 654,800 tons in 1927. Exports of bauxite in 1931 amounted to 167,853 tons, compared with 258,675 tons in 1930, 240,415 tons in 1929, 250,755 tons in 1928, and 262,339 tons in 1927. Exports of hydrous alumina amounted to 30,235 tons in 1930, 34,531 tons in 1929, and 29,491 tons in 1928.

The aluminum production of France[17] in 1931 was 24,000 metric tons, compared[18] with 29,000 tons in 1930, 29,083 tons in 1929, 25,867 tons in 1928, and 25,042 tons in 1927. Exports of aluminum in 1931 amounted to 2,533 tons, compared with 3,066 tons in 1930, 2,334 tons in 1929, 3,106 tons in 1928, and 7,024 tons in 1927. Imports for several years have averaged less than 1,000 tons.

Consumption[19] amounted to about 20,000 tons in 1930, compared with 25,000 tons in 1929, 24,400 tons in 1928, 18,000 tons in 1927, and 24,000 tons in 1926.

The French aluminum and bauxite industry is located chiefly on the east side of the Rhône Valley near the Alps and the boundaries of Switzerland and Italy. During recent years Var has been the center of bauxite production, followed by Hérault, Ariège, and Bouches-du-Rhône; in 1928 Var furnished 81 per cent and Hérault 16 per cent of the total.

As a result of successive consolidations only two great companies now produce aluminum in France. The Compagnie des Produits Chimiques et Electrométallurgiques Alais, Froges et Camargue (popularly known as Pechiney) has alumina works at St. Auban, Salindres, and Gardanne; it has reduction works at 10 different points, determined chiefly by available power. The Société d'Electrochimie, d'Electrométallurgie et des Aciéries Electriques d'Ugine, with alumina works at La Barasse, has reduction works at three different points. Both these dominant producers join in a third company, Aluminium Français, which serves as their sales organization and as a fabricator of aluminum.

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[16] Danmarks Statistik Handelsstatistiske Meddelelser, Vareomsaetningen med Udlandet: December, 1931, Copenhagen, 1932.

[17] American Bureau of Metal Statistics, Yearbook, 1931: New York, 1932, p. 105.

[18] Metallgesellschaft, 1920–1930, 32d year, pp. 4 and 26.

[19] See footnote 17.

The total capacity of the industry is now about 40,000 tons of aluminum annually, divided among 14 small plants, the two most important being the St. Auban and the l'Argentière works on the Durance River (Hautes Alpes); each has a normal annual capacity of 6,000 tons of various products.

GERMANY

The production of aluminum[20] in Germany during 1931 totaled 25,000 metric tons, compared with 30,200 tons in 1930, 32,700 tons in 1929, 31,700 tons in 1928, and 28,400 tons in 1927. Although there was a reduction of domestic consumption, which usually takes 85 per cent of domestic production, German exports of semifabricated and manufactured aluminum products[21] increased slightly—from 17,902 metric tons in 1930 to 18,107 tons in 1931—but the value of these products was reduced materially. The price of aluminum was reduced to £80 on January 1, 1932, under the provisions of the cartel. Early in January, 1932, German stocks were reported as 17,000 tons, said to be 11 per cent of total world stocks. Production of aluminum manufactures was on a 40 per cent basis late in 1931, although foil manufacturers were reported to be working at full capacity.

There are 5 concerns now producing raw aluminum, 25 mills making rolled products, and 63 foundries of the fabricating plants; the rolling mills use 45 per cent of the domestic raw aluminum.

German imports of bauxite[22] and cryolite in 1931 amounted to 210,989 metric tons, compared with 300,378 tons in 1930, 386,972 tons in 1929, and 432,258 tons in 1928. In 1931 France provided 82,982 tons, Hungary 63,818 tons, Yugoslavia 45,962 tons, Italy 16,092 tons, and Denmark 2,096 tons (largely cryolite). Considerable difficulty has been encountered in obtaining an assured supply of bauxite at reasonable cost. German concerns have sought control of bauxite in Hungary, Yugoslavia, and Italy, but most of these efforts have met political and other complications. Comparison of imports of bauxite from various sources shows that imports from Hungary decreased from 182,000 tons in 1928 to 64,000 tons in 1931; imports from Italy dropped from 72,000 tons in 1929 to 16,000 tons in 1931; imports from France decreased from 146,000 tons in 1929 to 83,000 tons in 1931; and imports from Yugoslavia increased slightly—from 43,000 tons in 1928 to 46,000 tons in 1931.

During 1931 the Aluminum Industrie, A. G. (Neuhausen)[23] expended a considerable sum in extending its Rheinfelder aluminum plant and the Chippas power station. This company reported reduced sales during 1931. The Aluminium and Magnesiumfabrik (Hemelingen)[24] carried a deficit for the past two years; and since the agreement between them and I. G. Farbenindustrie, A. G., expired in December, 1930, and was not renewed, it has been decided to liquidate the property.

A subsidiary of the United Aluminum Works Co. has asked for an import duty on aluminum foil scrap, which at present enters Germany free, because importers are able to use this material for other purposes than remelting.

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[20] American Bureau of Metal Statistics, Yearbook, 1931: New York, 1932, p. 105.

[21] Redecker, Sydney B., The Aluminum Trade and Industry in Germany: Com. Repts. No. 11, Mar. 14, 1932, pp. 622–624.

[22] Monatliche Nachweise über den auswärtigen Handel Deutschlands, December, 1931: Berlin, 1932, p. 88.

[23] Metal Bulletin (London), No. 1681, Apr. 8, 1932, p. 16.

[24] Metal Bulletin (London), No. 1606, July 7, 1931, p. 8.

German producers joined the new cartel organized in 1926.

GREECE

Small sporadic production of bauxite has been made from the limestone regions of western Greece. This increased to 6,280 tons in 1929 but declined to 1,317 tons in 1930.

HUNGARY

The production figure for 1931 is not yet available; but production of bauxite in Hungary for 1930 amounted to 31,696 tons, compared with 389,152 tons in 1929, 395,974 tons in 1928, and 339,464 tons in 1927. Exports [25] amounted to 75,904 tons in 1931, compared with 83,916 tons in 1930, 100,549 tons in 1929, 183,487 tons in 1928, and 228,504 tons in 1927. Chief exports are taken by Germany and the remainder by Austria, Czechoslovakia, and Rumania.

The Official Geological Survey of Hungary [26] states that the two districts of Hungary have about 200,000,000 tons of bauxite reserves; but only two mines were active in 1931, both in the Vertes district. Part of the production goes directly to export, and part is consumed locally in the manufacture of aluminous cements and aluminum salts.

ITALY

Italy produced 67,400 tons of bauxite in 1931, compared with 161,000 tons in 1930, 192,800 tons in 1929, 162,200 tons in 1928, and 95,300 tons in 1927.

Bauxite deposits are found largely at Lecce di Marsi and Pescolido, Abruzzi, and in Istria, and the reserves have been estimated [27] at 13,600,000 tons, having a content of 40 to 63 per cent Al_2O_3. Of these reserves, 8,100,000 tons are in Istria and 5,500,000 in Abruzzi.

The production of aluminum [28] in 1931 amounted to 10,960 metric tons, compared with 7,968 tons in 1930, 7,373 tons in 1929, 3,548 tons in 1928, and 2,544 tons in 1927.

The Società Veneto dell' Alluminio has increased the capacity of the Bussi plant in Abruzzi. Its plants at Borgofranco, Porto Marghera, and Mori, using the Haglund electrometallurgical process, have a present producing capacity of about 13,500 tons of raw aluminum.

The Blanc process [29] is to be utilized in Aurelia at the Civitavecchia plant by Società Italiana dell' Alluminio to recover potash as well as aluminum from leucite rocks. The plant is reported to have an annual capacity of 250,000 tons of potassium salts and a large quantity of aluminum. As [30] reserves of aluminum in the leucite of Naples and Orvieto are estimated at about 30,000,000 tons, such a plant would have a relatively long life, if successful.

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[25] Bulletin Statistique Mensuel Hongrois: Year 33, October-December, 1930, p. 504; year 34, October-December, 1931, p. 487.

[26] Metal Bulletin (London), No. 1507, Feb. 10, 1931, p. 16.

[27] Redecker, S. B., Consular Rept. 329,797 (7,563), Feb. 15, 1930, pp. 8-10.

[28] American Bureau of Metal Statistics, Yearbook, 1931: New York, 1932, p. 105.

[29] Chemical Markets, Growth of the Italian Chemical Industry Continues: Vol. 28, No. 2, February 1931, p. 140.

[30] American Metal Market, vol. 38, No. 121, June 24, 1931, p. 4.

Italian consumption[31] of aluminum has increased steadily from 4,200 metric tons in 1928 to 10,000 tons in 1930.

Exports[32] of aluminum during 1931 were 2,953 tons, compared with 710 tons in 1930.

The following quotation[33] indicates the attitude of Italian producers toward the new cartel:

> Despite the fact that the Italian aluminium industry is connected with interests associated in the newly formed Alliance Aluminium Co., the Italian Minister for Economics, Signor Bottai, has declared that the industry will not allow itself to be diverted in any way from its policy of development in the Italian interest by any international considerations or cartel decisions, its object being to increase output and to reduce prices. This seems tantamount to a defiance of the cartel which may therefore have to reckon on appreciable Italian competition in the near future.

A new set of Italian tariffs on aluminum and aluminum products is given on page 9 of the Metal Bulletin (London), No. 1622, September 4, 1931.

NORWAY

Norway produces no bauxite, but its water power has made it an important producer of aluminum from imported bauxite. Production[34] of aluminum in 1931 amounted to 21,421 metric tons. Total exports[35] in 1931 amounted to 24,351 tons.

NORWAY.—*Imports of bauxite, alumina, and cryolite and production and exports of aluminum, 1927–1931, in metric tons*

Year	Bauxite and alumina imports	Cryolite imports	Aluminum	
			Production	Exports
1927	42, 650	1, 954	20, 847	22, 077
1928	52, 636	2, 385	24, 779	16, 842
1929	67, 677	2, 301	29, 142	29, 813
1930	68, 716	2, 060	27, 357	23, 676
1931	48, 812	1, 521	21, 421	24, 351

Principal exports of aluminum in 1930 went to the United Kingdom (39 per cent) and to Russia (27 per cent).

The Norske Aluminium Co.[36] at Höyanger has just concluded negotations with the Government of the Union of Soviet Socialist Republics for sale of 8,000 tons of aluminum. Last year this concern shipped 10,000 tons to the Union of Soviet Socialist Republics. The capacity of the Höyanger plant is now about 11,000 tons annually.

The principal companies operating aluminum-reduction works include the following:

1. Aktieselskapet Stangfjordens Elektrokemiske Fabriker, at Stangfjord (owned by the British Aluminium Co.) (annual capacity, 400 tons).
2. Aktieselskapet Vigelands Brug, at Vigelands (owned by the British Aluminium Co.) (annual capacity, 3,000 tons).

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[31] American Metal Market, vol. 38, No. 156, Aug. 12, 1931, p. 4.

[32] U. S. Bureau of Foreign and Domestic Commerce, Foreign Trade Notes: No. 381, Apr. 2, 1932, p. 2.

[33] Metal Bulletin (London), No. 1646, Nov. 27, 1931, p. 15.

[34] American Bureau of Metal Statistics, Yearbook, 1931: New York, 1932, p. 105.

[35] Norges Officielle Statistikk, Månedsopgaver over Vareomsetningen med Utlandet: December, 1931, Oslo. 1932, pp. 228–229 and 237.

[36] American Metal Market, vol. 30, No. 86, May 5, 1932, p. 3.

3. Det. Norske Nitridaktieselskab, at Eydehavn and Tyssedal (owned by Compagnie A. F. C., British Aluminium Co., and Aluminium (Ltd.) (annual capacity, 15,000 tons in 1929).
4. Norske Aluminium Co., at Höyanger (owned jointly by Norwegian interests and Aluminium (Ltd.) (annual capacity, 6,500 tons).
5. A. S. Haugvik Smelteverk, at Glomfjord (annual capacity, 8,000 tons).

Norway is fortunate in possessing hydroelectric power sites on excellent harbors. The first production of aluminum was made in 1908. The total rated annual capacity in 1930 was about 36,000 tons, of which the subsidiaries of Aluminium (Ltd.) produced a considerable part.

RUMANIA

Rumania produced 678 metric tons of bauxite in 1930, compared with 926 tons in 1929, 653 tons in 1928, 1,706 tons in 1927, and 745 tons in 1926.

The Otavi Minen und Eisenbahn Gesellschaft has purchased bauxite properties in the Bihar Mountains of western Rumania.[37] These deposits are said to have from 2,000,000 to 10,000,000 tons of reserves in sight and possible extension to as much as 20,000,000 tons. The better grade of red ore runs 55.6 per cent Al_2O_3, 3 per cent SiO_2, 25.3 per cent Fe_2O_3, and 11 per cent moisture; a gray ore runs about 69 per cent Al_2O_3, 12 per cent SiO_2, 3 per cent Fe_2O_3, and 15 per cent water.

RUSSIA

The plan of the Union of Soviet Socialist Republics for creating an aluminum industry has been productive of many reports, the real significance of which can not be evaluated with assurance.

The new Russian 5-year plan [38] calls for an aluminum production capacity of 20,000 tons at Leningrad, 30,000 tons at Dnieper, 200,000 tons at the Minusinsk plant in the Caucasus, 100,000 tons at the Ural plants, and 50,000 tons at Bobrov, a total of about 400,000 tons of aluminum for 1938. It also calls for an output of over 20,000 tons of aluminum by the end of 1932–33.

The Dnieprostroi plant,[39] now being constructed, is expected to have an annual capacity of about 10,000 tons of raw aluminum. This and the new plant at Leningrad would provide an aluminum-producing capacity of nearly 16,000 tons before the end of 1932.

The plant [40] at Alapaevsk in the Urals was expected to be completed in March, 1931, with a reported annual capacity of 30,000 tons of aluminum. Plans call for this to be increased eventually to 75,000 tons.

The Angara-Ilimsky project [41] will utilize part of the 35,000,000 kilowatts produced at the Bratsk and Shamansk rapids. A large tonnage of aluminous ores of the Oka-Zuna district is to be used at this plant.

The new estimates [42] of alunite in the Union of Soviet Socialist Republics indicate about 93,000,000 tons, containing about 10,000,000 tons of aluminum. The Bobrikow (Bobrov) plant will endeavor to furnish the alumina necessary for the Dnieprostroi aluminum plant.

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[37] Daily Metal Reporter (Int. Monthly Sec.), vol. 29, No. 54, March, 1929, p. 14.
[38] Bureau of Foreign and Domestic Commerce, The Second Five-Year Plan for the Nonferrous Metallurgy: Russian Econ. Notes, No. 142, July 31, 1931.
[39] Engineering and Mining Journal, vol. 131, No. 3, Feb. 9, 1931, p. 151.
[40] Engineering and Mining Journal, vol. 133, No. 1, Jan. 7, 1932, p. 62.
[41] Russian Economic Notes, Angara Water Power Project: No. 168, Bureau of Foreign and Domestic Commerce, Feb. 12, 1932.
[42] Metal Bulletin (London), No. 1626, Sept 18, 1931, p. 10.

A commission[43] was set up to study new sources of aluminum raw materials and to study further locations for new aluminum plants. One promising project[44] disclosed recently is the development of a large deposit of aluminous ores in Transcaucasia. The Zaglisky deposits are believed to insure a large-scale production of aluminum as well as various chemicals such as sulphuric acid and sulphur.

SPAIN

Spain produced 323 metric tons of bauxite in 1930, compared with 975 tons in 1929. Its annual consumption of aluminum amounts to about 1,500 metric tons.

Spain is the most recent country to enter the aluminum-producing field. The only works are at Sabiñanigo, Province of Huesca, where the plant is operated by the Aluminio Español, S. A.; it has a rated capacity of 1,200 tons a year. Production[45] of aluminum amounted to 1,000 metric tons in both 1930 and 1931. Imports of alumina amounted to 2,500 metric tons in 1929.

SWITZERLAND

Switzerland[46] produced 16,000 metric tons of aluminum in 1931, 20,500 tons in 1930, and 20,700 tons in 1929. Exports of aluminum and aluminum manufactures were 12,795 tons in 1931, compared with 15,037 tons in 1930. In 1930 raw aluminum exports totaled 9,233 tons, compared with 13,212 tons in 1929. Imports amounted to 704 tons in 1931, compared with 2,261 tons in 1930.

The following table gives statistics of the Swiss aluminum industry for 1926 to 1930:

SWITZERLAND.—*Imports of alumina and production, exports, and consumption of aluminum, 1926–1930, in metric tons*

Year	Alumina imports	Aluminum		
		Production	Exports	Consumption
1926	31,685	21,000	15,443	5,800
1927	40,323	20,000	13,393	7,000
1928	45,544	19,900	15,045	6,000
1929	42,201	20,700	13,212	8,000
1930	(1)	20,500	[2] 9,233	7,000
Annual average	(1)	20,420	13,265	6,760

[1] Data not available.
[2] Total exports of aluminum and semimanufactures amounted to 15,037 metric tons in 1930.

Exports of raw aluminum (9,233 metric tons) went to the following countries in 1930: Germany, 31 per cent; Great Britain, 18 per cent;

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[43] Metal Bulletin (London), No. 1617, Aug. 18, 1931, p. 20.
[44] Mining Journal (London), vol. 175, No. 5026, Dec. 19, 1931, p. 952.
[45] Revista Minera, Metallurgica y de Ingenieria: Vol. 83, No. 3298, Madrid, Feb. 1, 1932, p. 49.
[46] American Bureau of Metal Statistics, Yearbook, 1931: New York, 1932, p. 105.

Japan, 15 per cent; United States, 13 per cent; Belgium, 7 per cent; Italy, 4 per cent; and other countries, 12 per cent. In 1929, Germany took 26 per cent; United Kingdom, 21 per cent; United States, 14 per cent; Japan, 14 per cent; Belgium, 10 per cent; Italy, 6 per cent; and other countries, 9 per cent.

The new aluminum cartel met in Switzerland on December 31, 1931, and was named the Alliance Aluminum Co. (Ltd.). The Swiss company—Aluminium Industrie A. G. (Neuhausen)—has two members on the board of directors, while the other countries have one.

Swiss production [47] of aluminum was reported to be about 50 per cent of capacity near the end of 1931. This decrease was due partly to German embargoes.

The Swiss aluminum-reduction plants include:

1. Aluminium Industrie, A. G., or Société Anonyme pour l'Industrie de l'Aluminium, with plants at Neuhausen and Chippis (Neuhausen is just west of Lake Constance, and Chippis is in southwest-central Switzerland). The latter is the more important.
2. Fabrique d'Aluminium Martigny, S. A., at Martigny-Bourg, in the Canton of Valais (on the French border west and south of Chippis works) (annual production about 1,800 tons).

UNITED KINGDOM

The only bauxite produced in the United Kingdom comes from Northern Ireland near Belfast at Larne Harbor, County Antrim. Bauxite from this source, however, has not been able to compete successfully with foreign ores. The average annual production from 1927 to 1930, inclusive, amounted to about 3,000 tons, the output in 1930 being 2,070 metric tons.

Production of aluminum in 1931 amounted to 14,300 metric tons, compared with 14,000 tons in 1930, 13,900 tons in 1929, and 10,700 tons in 1928.

Early in 1932, for the first time,[48] the United Kingdom exported to Germany, particularly to points where freight rates favored British shippers over German producers. Evidently the exchange favors the British since they went off the gold standard.

The following article indicates the effect of the new British Tariff Act on the Norwegian aluminum industry:[49]

> Although since the opening of the North British Aluminium Co.'s plant at Kinlochleven last year the output capacity in the British Isles is ample for home trade requirements, the tariff will not be without some effect on the aluminium market here. A substantial proportion of the imports of raw aluminium has come from Norway where the British producers' subsidiaries have reduction plants, and presumably all this metal will now find a market on the Continent rather than pay a 10 per cent import duty. Against this, however, practically all the bauxite used for the production of the metal here is imported from abroad and consequently will have to pay duty, to say nothing of the petroleum coke and other substances needed for the electrodes, which constitute no small proportion of the expenses of aluminium production.

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[47] Hukill, George R., Swiss Aluminum Industry: Foreign and Domestic Commerce Special Circ. 21, Dec. 19, 1931, Washington, 1931, p. 3.

[48] Mining Journal (London), vol. 176, No. 5033, Feb. 6, 1932, p. 101.

[49] Metal Bulletin (London), No. 1668, Feb. 16, 1932, p. 20.

British aluminum statistics for 1928 to 1930 are summarized in the following table:

UNITED KINGDOM.—*Imports and exports of various aluminum raw materials and imports, exports, production, and consumption of aluminum, 1928–1930, in metric tons*

Material[1]	1928		1929		1930	
	Exports	Imports	Exports	Imports	Exports	Imports
Alumina	15,702	1,077	20,916	924	13,873	1,099
Bauxite		111,262		123,109		142,274
Cryolite		1,572		1,742		2,663
Aluminum sulphate	13,576	27,432	14,889	27,392	11,229	24,270
Ingots, alloys, scrap	5,983	13,583	5,728	22,647	4,190	18,604
Wire, sheets, etc	3,892	5,199	3,835	6,543	3,804	5,507
Aluminum:						
Production[2]	10,700		13,900		14,000	
Consumption[3]	17,000		30,000		24,000	

[1] Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Countries, 1930: London, 1931, p. 70. (Also Imperial Institute, Statistical Summary; Ann. Rept., 1928-1930: London, 1931.

[2] American Bureau of Metal Statistics, Yearbook, 1931, p. 105.

[3] Metallgesellschaft, 1920-1930, Frankfort am Main, 1931, pp. 3-5 and 26.

In the recent past about two-thirds of British imports of aluminum came from Norway and 20 per cent from Canada. Bauxite was obtained chiefly from France.

The principal companies operating alumina plants include:

1. British Aluminium Co. (Ltd.), at Larne Harbor, County Antrim, Ireland, and at Burnt Island, Fifeshire, Scotland.
2. International Aluminium Co. (Ltd.) (owned by Aluminium Co. (Ltd.)), at Hebburn, Newcastle-on-Tyne, England.

The main aluminum-reduction plants are as follows:

1. British Aluminium Co. (Ltd.), at Kinlochleven, Argyllshire, Scotland, and at Foyers, Invernessshire, Scotland.
2. North British Aluminium Co. (Ltd.) (owned by British Aluminium Co. (Ltd.)), at Fort William, Invernessshire, Scotland. Here early in 1930 the first 53,000-horsepower unit of the Lochaber hydroelectric plant was completed; 120,000 horsepower will be developed ultimately.[50]
3. Aluminium Corporation (Ltd.), at Dolgarrog Sidings, near Llanrwst, North Wales.

In addition, Aluminium (Ltd.) controls the Northern Aluminium Co., the Aluminium Casting Co. (Ltd.), and the Aluminium Rolling Works, at Banbury.

YUGOSLAVIA

Yugoslavia produced 94,700 metric tons of bauxite in 1930, compared with 103,366 tons in 1929, 49,264 tons in 1928, 100,327 tons in 1927, and 131,828 tons in 1926. Exports[51] of bauxite in 1930 amounted to 60,591 tons, of which 51,138 tons went to Netherlands, 5,385 tons to Germany, and 3,585 tons to Italy. The ore sent to Netherlands was probably transshipped to Germany.

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[50] Canadian Mining Journal, vol. 51, No. 50, Dec. 12, 1930, p. 1204.

[51] Imprimerie Nationale, Ministère des Finances Statistique du Commerce Extérieur de Royaume de Yugoslavie: 1930, p. 55.

The principal deposits[52] occur in northern and central Dalmatia, Bosnia and Herzegovina, Slovenia, and western Croatia, those of Dalmatia being the most important. The richest ores are along the Adriatic coast; the ore contains 50 to 60 per cent Al_20_3 and 0.25 to 3 per cent SiO_2.

The Adria Bauxit Rudarsko Industrijsko, D. D. Zagreb, works a mine at Umka (at Drnish in Knin District, Dalmatia). This concern has produced nearly 75 per cent of the total output; it employs about 500 men. The Umka mine produced 9,123 metric tons in 1920, 102,859 tons in 1926, and 50,415 tons in 1929.

The Aluminij Rudarsko i Industrijsko, D. D. Split,[53] owns 13 properties (not working) and has leased them to Kontinentalno Bauxitno Rudokopno i Industrijsko, D. D. Zagreb. The lessee is working the Kalum mine, 10 kilometers from Drnish. The production in 1920 amounted to 2,374 tons, but that in 1929 amounted to 43,643 tons.

Two French[54]-controlled mines, at Jesenitsa and Krousheva, and two mines at Knin have a combined output of less than 10,000 tons annually. Among the inactive mines during 1930 were the scattered mines of the Telluria D. D. at Zagreb; the Bosnia Rudarska Zadruga at Sarajevo; government properties in Herzegovina on the banks of Neretva River and at Rozor; and some scattered companies with offices at Split.

The only aluminum production is from a small plant at Mostone, near Ljubljana; but nearly 4,800 tons of aluminum hydroxide were exported[55] during 1930, most of which went to Austria.

The three main companies[56] were reported to have produced 155,825 tons in 1930, of which only 69,882 tons was sold. The output in 1929 was 103,366 tons, compared with 49,264 tons in 1928. This production came largely from Boka Kotorska; Obrovac; the islands of Hvar, Rrk, and Rab; Drnis; etc.

The deposits[57] along the valleys of the Drave and Save Rivers have been estimated to contain 80,000,000 to 100,000,000 tons, much of which averages 60 per cent Al_2O_3 and less than 1 per cent silica.

ASIA

INDIA

India produced[58] 2,554 metric tons of bauxite in 1930, compared with 9,189 tons in 1929. Of the 1930 output the Jubbulpore district in Central Provinces furnished 1,824 tons and the Kaira district in Bombay 730 tons.

Aluminous (bauxite) deposits of consequence occur on the Baihir Plateau in the Balagat district and in the vicinity of Katni in the Jubbulpore district, both in the Central Provinces. Good bauxite has been found in the laterite plateau in the western part of Chota Nagpur and in Sarguja (Bihar and Orissa) in the Satara district

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[52] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes: No. 349, Aug. 8, 1931.
[53] See footnote 52.
[54] See footnote 52.
[55] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes: No. 34, Aug. 24, 1931, p. 1.
[56] Metal Bulletin (London), No. 1585, Apr. 14, 1931, p. 16.
[57] Mining Journal (London), The Mining Industry of Yugoslavia: Vol. 175, No. 5018, Oct. 24, 1931, p. 796.
[58] Geological Survey of India, Records: Vol. 65, pt. 3, Calcutta, 1931, p. 359.

(Bombay), and in various parts of Madras Presidency. The Balagat bauxites have the following range of composition:

	Per cent
Alumina [59]	51.62–58.83
Silica	.05– 2.65
Ferric oxide	2.70–10.58
Titanium dioxide	6.22–13.76
Combined water	22.76–30.76
Moisture	.40– 1.14

Imports [60] in 1931 comprised 2,566 metric tons of aluminum sulphate, 1,406 tons of alum, and 2,514 tons of metallic aluminum and aluminum products (largely circles). In 1930 the corresponding figures were 3,370 tons, 1,384 tons, and 7,838 tons, respectively. Aluminum circles amounted to 2,153 tons in 1931, 7,302 tons in 1930, and 8,036 tons in 1929. Exports of bauxite [61] in 1930 amounted to 2,729 metric tons, compared with 3,534 tons in 1929; 1931 figures were not listed separately.

JAPAN

Japan imported 2,454 tons [62] of aluminum ingots in 1931, compared with 10,965 tons in 1930, 11,894 tons in 1929, and 9,168 tons in 1928.

A recent report [63] indicates that the Japanese Government, under the Inukai Ministry, has devised a 5-year plan in regard to aluminum as follows:

> Japanese advices report that the new Government in Japan, the Inukai Ministry, intends carrying out the five-year industrial plan drawn up by the Seiyu Party, under which the Department of Commerce and Industry is making inquiries into the possibility of establishing an aluminium-producing industry in Japan by the formation of a company capable of producing 12,000 tons a year, which would be sufficient to satisfy the home requirements. A Government subsidy would be granted to the company for five years, amounting to 5,500,000 yen. This project has been discussed at various times for some years past but nothing has been done, although leading metal firms in Japan have announced their willingness to undertake the production of aluminium under suitable financial guarantees from the Government.

The raw material for this industry is to be obtained from South Sea Islands.

It is expected [64] that the Sumitomo Aluminium Co. will be in a position to market aluminum foil by May or June, 1932.

The production [65] of aluminum utensils has reached an important position in Japanese manufacture, and the utilization of such utensils has become widespread. Recent developments indicate that the importation of aluminum ingots has been decreased in favor of scrap and sheet aluminum.

The First Aluminum Industrial Co.[66] of Kyoto is now making ingots, sheets, and slabs from scrap and quoting a price of 2 to 2¼ cents per pound under the import price. The Japanese have been manufacturing considerable duralumin.

Imports of cryolite [67] in 1930 amounted to 2,996 metric tons, compared with 1,031 tons in 1929 and 888 tons in 1928.

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[59] Content after calcination is 71.2 to 80.8 per cent Al_2O_3.

[60] Seaborne Trade and Navigation of British India, December, 1931, pp. 29–30 and 47.

[61] Imperial Institute, Statistical Summary; Ann. Rept. 1928–1930: London, 1931.

[62] Skillings' Mining Review, vol. 20, No. 47, Mar. 26, 1932, p. 2.

[63] Metal Bulletin (London), No. 1672, Mar. 1, 1932, p. 16.

[64] Metal Bulletin (London), No. 1678, Mar. 22, 1932, p. 19.

[65] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes: No. 377, Mar. 5, 1932, p. 5.

[66] Iron Age, Japanese Aluminum Plant Undersells Importers: Vol. 128, No. 15, Oct. 8, 1931, p. 980.

[67] Imperial Institute, Statistical Summary; Ann. Rept. 1928–1930: London, 1931.

OCEANIA

AUSTRALIA

Bauxite deposits have been found 60 miles southwest of Gladstone at Crows Nest near Toowoomba, and at Cooranga station in the Gayndah district, Queensland, and numerous high-iron bauxite deposits are known in New South Wales. Aluminous clays, alunite, and bauxitic clays have been found in other sections of Australia. Production has been small and has come chiefly from Victoria, which produced 555 metric tons of bauxite in 1929, compared with 196 tons in 1928 and 936 tons in 1927; figures for Victoria are not available since 1929. New South Wales began production with 199 metric tons in 1931.

Deposits of bauxite material[68] have been discovered in South Gippsland, Victoria, by James Barrett. Over 3,500 tons have been shipped to Melbourne for treatment.

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[68] Clark, Donald, Bauxite in Victoria: Industrial Australian and Mining Standard, vol. 86, No. 2205, Aug. 20, 1931, p. 129.

TUNGSTEN [1]

By F. L. Hess [2]

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THE YEAR 1931 IN THE UNITED STATES

The year 1931 began, continued, and ended during a period of great business depression, which naturally was reflected in the sale and production of tungsten. However, owing to the very high duties on tungsten, domestic production, most of which was made by one company, increased. Shipments of tungsten concentrates were equivalent to 1,404 short tons carrying 60 per cent WO_3, valued at $928,000 ($11.02 per unit). In 1930 shipments were very low and amounted to only 702 tons, valued at $509,000 ($12.09 per unit).

The production of tungsten concentrates in the United States during the past five years is shown in the following table.

Concentrated tungsten ores (reduced to equivalent of 60 per cent WO_3) produced in the United States, sold in 1927–1931, and average price per unit

Year	Short tons	Value	Average price per unit
1927	1, 164	$724, 000	$10. 37
1928	1, 208	753, 900	10. 40
1929	830	654, 000	13. 13
1930	702	$509, 000	$12. 09
1931	1, 404	928, 000	11. 02

Shipments in 1931 consisted of 1,203 tons of scheelite and 201 tons of ferberite, huebnerite, and wolframite. Most of the scheelite was from Nevada, with less from Atolia, Calif., and other fields; the ferberite was from the Boulder County field in Colorado, the huebnerite from Arizona, and the small quantity of wolframite from Arizona and Washington.

The largest operator in the United States was again the Nevada-Massachusetts Co., mining principally in the Eugene Mountains about 12 miles north of Mill City, Nev. Here the company mines limestone beds 3 or 4 feet thick which have been metamorphosed by granitic intrusives, solutions from which introduced scheelite into the limestone. The ore as mined carries about 1.10 per cent scheelite, which is equivalent to 0.887 per cent WO_3. The mines have reached a depth of 800 feet and are still in ore. The company mined some scheelite from the Silver Dyke, a great netted vein 9 miles west of

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[1] Work on manuscript completed June, 1932.

[2] Statistics on domestic production prepared by H. W. Davis and figures on foreign production compiled by L. M. Jones, both of the Bureau of Mines. Figures on imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Mina, Nev., but did not operate its Ragged Top (contact metamorphic, scheelite) deposit or its property (contact metamorphic) near Quartz Mountain. At the old camp of Ellsworth, near Ione, Nev., from which the mineral huebnerite was first described, James L. Corlett and Don Benton erected a 30-ton mill and deepened a shaft to 65 feet, following a vein which carries huebnerite and scheelite. E. T. Heggland concentrated some scheelite near Mina.

In California scheelite was mined from contact metamorphic deposits by Cooper Shapley and associates in Round Valley near Bishop; by A. E. Beauregard near Laws; and by J. H. Kennedy at Posey. It was reported that in the spring the deposits in Round Valley were examined and that a mill test was made on them by the Tonopah Mining Co.[3] Some scheelite was also produced by the Atolia Mining Co. from the desert débris at Atolia, Calif., and an ore shoot was discovered on the 1,300-foot level (following the incline) of its Union Mine. Information Circular 6532, Methods and Costs of Concentrating Tungsten Ores at Atolia, San Bernardino County, Calif., by W. O. Vanderburg, with the cooperation of A. V. Udell, Louis Warnken, and C. K. Dennis, was published by the United States Bureau of Mines, and is available for free distribution as long as the supply lasts.

In the Boulder ferberite (iron tungstate, $FeWO_4$) field at Nederland, Colo., the Wolf Tongue Mining Co., which has mined in that field continuously since 1905, carried on persistent prospecting and was rewarded by the discovery of a new ore body. George Cowdery, 3 miles south of Nederland, and the Clipper Tungsten Co., between Nederland and Boulder, produced small quantities of ferberite concentrates.

In Montana the Jardine Mining Co. at Jardine did no mining during the year but still had on hand 26 tons of scheelite concentrates.

In Washington James Keeth shipped a few tons of wolframite mined on the Spokane Indian Reservation, and the Consolidated Tungsten Mines 12 miles north of Deer Park prosecuted development work on a huebnerite-wolframite deposit. Under a bond and leasing agreement with the American Tungsten Co., The Tungsten Producers (Inc.) equipped a 25-ton mill on the old Germania wolframite claim 9 miles southeast of Fruitland and 50 miles north of Davenport,[4] and Tungsten Mines (Inc.) is reported to have produced some ore from claims 18 miles southwest of Addy, Wash.[5] The Northwest Tungsten Co. has a tungsten-bearing vein in a high ridge between Bumping River and Deep Creek about 70 miles by road northwest of Yakima, on which work has been done for two years. The vein is said to carry some copper and silver as well as tungsten.[6] The property was formerly known as the Cascadia gold-copper mines.

In Arizona the Boriana Mining Co. mined and shipped wolframite from the Hualpai Mountains near Yucca. This property was worked during the Great War by the Yucca Tungsten Co., a subsidiary of the York Metal & Alloys Co. The ore carries considerable chalcopyrite which is saved as a concentrate carrying 27 per cent copper and about \$9 in gold. The wolframite concentrates carry 66 per cent WO_3. A small quantity of wolframite was produced from the property of

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[3] Nevada Mining Press, May 1 and 8, 1931.

[4] Mining Journal (Phoenix, Ariz.), September, 1931, p. 32; November, 1931, p. 29.

[5] Mining Journal (Phoenix, Ariz.), December, 1931, p. 30.

[6] Mining Journal (Phoenix, Ariz.), June, 1931, p. 36; February, 1932, p. 29.

Lawler & Wood near Prescott. The Tungsten Alloys Corporation, a subsidiary of North American Mines (Inc.) of Boston, Mass., mined huebnerite at its mine in the Las Guigas Mountains 63 miles by road southwest of Tucson and about 25 miles west of Amado on the Tucson-Nogales branch of the Southern Pacific Railroad. Quartz veins cutting granite carry the huebnerite. The mill is about a mile from the mine, and ore is hauled to it in an automobile truck. The ore delivered to the mill during the first part of 1931 averaged 1½ to 2 per cent WO_3 and the tailing a little more than 0.2 per cent WO_3. The concentrates carry pyrite and chalcopyrite and about 40 per cent WO_3 and are sent to E. C. O'Brien & Co. at Globe for magnetic separation, by which means the WO_3 content is raised to a point between 60 and 65 per cent. As the concentrates are very high in manganese they are desirable only for those tungsten users who use wet methods, but as the ore is free from traces of molybdenum it is liked by producers of tungsten filaments for incandescent lamps. Sixty tons of concentrates carrying 64 per cent WO_3 were sold during 1931.

FOREIGN NOTES

The low world prices for tungsten ores outside the United States (probably at no time during the year much, if any, above $3 per long-ton unit at point of production) were not encouraging; yet there was a surprising production from Burma, where it had frequently been declared that a price of 20 shillings—a standard gold pound ($4.867)—or more per long-ton unit (equivalent to $4.35 per short-ton unit) for concentrates carrying about 65 per cent WO_3 was necessary for profitable production. According to customs returns quoted by L. C. Altaffer, American vice-consul, Rangoon, in a report dated January 15, 1932, the exports from Burma for 1930 and 1931 were as shown in the following table. The output is also given in equivalent short tons of 60 per cent WO_3 on the supposition that the concentrates, as shipped, average 65 per cent WO_3.

Tungsten concentrates exported from the Rangoon (Burma) customs district, 1930 and 1931, by quarters

Quarter	1930		1931	
	65 per cent WO_3(?) (long tons)	60 per cent WO_3 (short tons)	65 per cent WO_3(?) (long tons)	60 per cent WO_3 (short tons)
First	495	601	1,038	1,259
Second	678	823	1,203	1,460
Third	633	768	1,077	1,307
Fourth	1,454	1,764	1,150	1,395
Total	3,260 (3,312 metric tons)	3,956 (3,589 metric tons)	4,468 (4,540 metric tons)	5,421 (4,918 metric tons)

A considerable part of the concentrates came from the Mawchi Mine in the southern part of the Bawlake State of Karenni, one of the Southern Shan States. It is 16 miles east of Pazaung on the Salween River and 216 miles north of the port of Moulmein. In 1931, 2,935.5 long tons of concentrates were produced.[7] These are supposed to carry about 43 per cent wolframite [8] and 57 per cent cassiterite and would be equivalent to about 1,262 long tons of high-grade wolframite concentrates. If these are considered as carrying 65 per cent WO_3, as has been estimated for other Burmese ores, they would be equivalent to about 1,531 short tons of concentrates carrying 60 per cent WO_3. Virtually all the remainder of the shipments, equivalent to 3,890 short tons, except for a small quantity from Mergui, are supposed to have come from Tavoy. It must be made clear, however, that at present the real quantity of tungsten in the concentrates is unknown.

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[7] Skinner, W. E., Mining Year Book: 1932, p. 318.

China, as for years past, was the world's largest producer in 1931, with exports equivalent to about 8,259 short tons (7,492 metric tons) of 60 per cent WO_3. In these figures the concentrates have been estimated to carry 65 per cent WO_3. Almost the entire quantity went to Europe. The people of the tungsten-bearing region live so close to want that tungsten is produced at practically any price that is paid for it.

In the Federated Malay States the tungsten mineral produced was entirely scheelite and was presumably from the Kramat Pulai Mine 11 miles east of Ipoh, Perak. The output was 6,189 pikuls (a pikul equals 133⅓ pounds avoirdupois). Concentrates shipped to the United States have carried about 74 per cent WO_3, and on that basis the output was equivalent to 509 short tons (462 metric tons) of concentrates carrying 60 per cent WO_3.

Australia can produce very little tungsten at prevailing prices. Somewhat less than a hundred tons are produced yearly on the mainland and somewhat more than a hundred tons in Tasmania.

Bolivia has only one tungsten mine (Easley and Inslee's Conde Auque, between 25 and 30 miles northeast of Oruro) that can operate under present conditions. During 1931 about 34 metric tons per month of scheelite concentrates carrying about 60 per cent WO_3, equivalent to about 37 short tons, were shipped to Italy. The concentrates are supposed to have been converted into ferrotungsten for export to Russia.

Portugal is the only European country producing a significant quantity. Total figures are not at hand, but the Beralt Tin & Wolfram (Ltd.), having tin and tungsten properties at Panasqueira, Cabeço da Piao, about 5 miles from Silvares in the Province of Beira Baixa, District of Castelo Branco, produced 249½ long tons of wolframite concentrates and 165 tons of tin during 1931.[9] During May and June 700 to 800 employees were discharged.[10] The Companhia de la Ribeira operated in the Bragança District; and interested persons examined other properties in the Bragança, Arouca, and Ribeira da Pena Districts with a view to enlarging the company's operations. The Borralha & Cia. mines in the Minho region continued production, exporting the concentrates to the company smelter in France.[11]

In South Africa 24 metric tons of concentrates were shipped from Southern Rhodesia; also, wolframite was reported as found through a length of 9 miles in Gordonia, but details are meager.[12]

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[8] Brown, J. C., Tungsten: Geol. Surv. India Rec., vol. 64, 1930, p. 307.

[9] Skinner, W. E., Mining Year Book: 1932, p. 57.

[10] Mining Journal (London), vol. 174, 1931, p. 583.

[11] See footnote 10.

[12] South African Mining and Engineering Journal, Tungsten Deposits in the Cape: Vol. 42, pt. 1, 1931, p. 302.

The available figures for world production of tungsten concentrates, 1927 to 1931, are shown in the following table.

World production of tungsten ore, 1927–1931, in metric tons of concentrates containing 60 per cent WO_3

Country [1]	1927	1928	1929	1930	1931
North America:					
Mexico	----------	----------	11	28	(2)
United States	1,056	1,096	753	637	1,274
	1,056	1,096	764	665	(2)
South America:					
Argentina	10	24	63	98	(2)
Bolivia [3]	79	29	1,630	888	410
	89	53	1,693	986	(2)
Europe:					
Czechoslovakia	78	73	75	74	(2)
France	8	----------	1	----------	(2)
Great Britain (Cornwall)	12	96	27	153	(2)
Portugal	174	151	358	499	(2)
Russia [4]	10	----------	(2)	(2)	(2)
Spain	164	158	213	196	(2)
	446	478	674	922	(2)
Asia:					
China [3]	5,666	8,283	9,978	9,454	7,492
Chosen	5	161	15	13	(2)
India (Burma)	1,277	843	1,484	2,699	[5] 4,918
Indo-China (Tonkin)	213	175	198	220	248
Japan	49	54	61	81	(2)
Malay States—					
Federated Malay States	22	5	356	1,054	462
Unfederated Malay States	170	139	157	178	(2)
Netherland East Indies	22	8	10	15	(2)
Russia [4]	32	58	(2)	(2)	(2)
Siam	8	----------	[3] 62	[3] 7	[3] 12
	7,464	9,726	12,321	13,721	(2)
Africa: Southern Rhodesia	33	15	28	33	24
Oceania:					
Australia—					
Central Australia [6]	----------	----------	20	67	29
New South Wales	----------	----------	25	17	62
North Australia [6]	----------	----------	1	(7)	(2)
Queensland	3	29	22	24	3
Tasmania	176	209	180	133	(7)
New Zealand [3]	15	6	39	21	(2)
	194	244	287	262	(2)
	9,282	11,612	15,767	16,589	(2)

[1] In addition to the countries listed Ethiopia reports an experimental production of 100 tons of tungsten ore in 1928; content of WO_3 not stated. No further development of deposit reported.

[2] Data not available.

[3] Exports.

[4] Year ended Sept. 30.

[5] Exports. No details are available as to quality of concentrates, but it is assumed that the figures represent magnetically separated concentrates. If this is not correct, the figures should be considerably smaller.

[6] Part of Northern Territory prior to division in 1927 into Central Australia and North Australia.

[7] Less than 1 ton.

GENERAL CONDITIONS

During the year the Molybdenum Corporation of America smelted a considerable quantity of Chinese wolframite ore for the David Taylor Co., Inc. The ore was smelted in bond and exported to Russia. A number of carloads of domestic scheelite were used in exchange for Chinese ore to maintain the grade of the ferrotungsten.

Imports of tungsten concentrates and tungsten in metal or alloys during 1931 are shown in the following table.

Tungsten imported into the United States in 1931, by months

[General imports]

Month	Tungsten ore and concentrates			Tungsten metal and alloy	
	Gross weight (pounds)	Tungsten content (pounds)	Value	Tungsten content (pounds)	Value
January	313, 040	179, 716	$39, 040	10, 791	$5, 361
February	84, 160	46, 684	10, 879	66	147
March	78, 288	50, 281	9, 980	81	134
April	404, 000	192, 816	36, 208	10, 849	5, 459
May	22, 400	11, 648	1, 918	110	61
June	533, 917	282, 243	47, 514	106	333
July	472, 500	273, 162	44, 575	272	649
August	----------	----------	----------	127	291
September	22, 132	12, 040	3, 000	39, 362	16, 477
October	----------	----------	----------	39, 461	16, 695
November	366	18	9	360	774
December	78, 400	40, 768	5, 600	510	1, 097
	2, 009, 203	1, 089, 376	198, 723	102, 095	47, 478

The tungsten imports for consumption during 1930 and 1931 have been as follows:

Tungsten imported for consumption in the United States, 1930 and 1931

	1930				1931	
	Jan. 1–June 17		June 18–Dec. 31			
	Pounds	Value	Pounds	Value	Pounds	Value
Tungsten ore and concentrates (W content)	3, 607, 744	$1, 498, 645	87, 150	$36, 124	167, 352	$48, 288
Tungsten metal	(1)	(1)	41, 706	26, 247	20, 126	11, 716
Combinations containing tungsten or tungsten carbide (W content)	(1)	(1)	108	275	3	24
Tungstic acid and other compounds of tungsten, not specially provided for (W content)	(1)	(1)	203	2, 197	1, 795	3, 819
Tungsten and ferrotungsten, tungsten chemicals, powder, and acid (W content)	257, 625	169, 581	----------	----------	----------	----------
Tungsten-nickel and other alloys of tungsten, not specially provided for (W content)	3, 598	219, 026	16	580	----------	----------
	3, 868, 967	1, 887, 252	129, 183	65, 423	189, 276	63, 847

[1] Not separately recorded prior to tariff of June 18, 1930.

Tungsten stocks in bonded warehouses, December 31, 1930 and 1931, were as follows:

Tungsten stocks in bonded warehouses on December 31, 1930 and 1931, by customs districts

Customs district	Ore			
	Tungsten content (pounds)		Value	
	Dec. 31, 1930	Dec. 31, 1931	Dec. 31, 1930	Dec. 31, 1931
New York	550, 186	916, 736	$185, 265	$209, 692
Pittsburgh	518, 187	710, 579	160, 805	188, 623
Buffalo	201, 810	170, 876	65, 371	57, 379
Philadelphia	35, 059	29, 387	8, 637	7, 361
Ohio	15, 819	6, 816	4, 840	2, 052
Total	1, 321, 061	1, 834, 394	424, 918	465, 107
	Alloys			
Los Angeles	22, 117	62, 921	$13, 552	$28, 800
Galveston		39, 218		16, 155
New York		280		387
Total	22, 117	102, 419	13, 552	45, 342

The apparent consumption of new tungsten in the United States since 1921 follows.

Apparent consumption of new tungsten in the United States, 1921–1931, as shown by imports and production less exports

Year	Supply (contained tungsten—pounds of metal)			Exports of ferrotungsten, tungsten metal, and wire (contained tungsten—pounds of metal, estimated)	Apparent consumption of new tungsten	
	In ore and alloys imported	In domestic ore shipped	Total		Pounds of metal	Equivalent in short tons of 60 per cent WO_3 concentrates
1921	2, 256, 528		2, 256, 528		2, 256, 528	2, 371
1922	2, 908, 360		2, 908, 360	1, 009	2, 907, 351	3, 055
1923	79, 021	229, 359	308, 380	4, 032	304, 348	320
1924	141, 858	537, 711	679, 569	3, 435	676, 134	710
1925	1, 693, 649	1, 133, 475	2, 827, 124	9, 930	2, 817, 194	2, 960
1926	2, 883, 867	1, 315, 000	4, 198, 867	23, 504	4, 175, 000	4, 387
1927	2, 198, 051	1, 108, 000	3, 306, 051	16, 114	3, 290, 000	3, 457
1928	2, 968, 839	1, 150, 000	4, 118, 839	13, 313	4, 105, 000	4, 314
1929	6, 446, 096	790, 000	7, 236, 096	82, 257	7, 154, 000	7, 517
1930	3, 998, 150	668, 000	4, 666, 150	23, 983	4, 642, 000	4, 878
1931	189, 276	1, 336, 215	1, 525, 491	[1] 1, 057, 754	467, 737	491

[1] Of this quantity, 1,017,226 pounds were shipped to Russia as ferrotungsten.

At the beginning of 1921 (the only year to that time for which stocks are approximately known) an equivalent of about 15,000 tons of tungsten concentrates carrying 60 per cent WO_3 was held in the United States. It seems probable that not more than 2,000 tons were held at the end of 1931, *exclusive of unshipped concentrates at the mines and in bonded warehouses.* The consumption from 1921 to 1931, inclusive, would therefore appear to have been 13,000 tons more than is shown in the summation of the last column and would average about 4,300 short tons (3,900 metric tons). This quantity is virtually the same as the estimate made in the 1930 report of this series, using the figures for five years and making no allowance for stocks.

Conversion charges for reducing concentrates to ferrotungsten fell to 15 cents a pound in 1931.

ANTIMONY[1]

By Paul M. Tyler[2]

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STATISTICAL SUMMARY

Summary of statistics for antimony in the United States, 1927–1931

	1927	1928	1929	1930	1931
Average price for year of antimony at New York cents per pound	12.34	10.30	8.94	7.67	6.72
Imports for consumption:					
Antimony in ore short tons	2,015	2,185	1,865	863	4,863
Liquated antimony sulphide do	1,077	1,208	1,803	713	650
Metal do	9,891	9,684	11,073	7,700	3,753
Oxide do	1,312	2,268	1,892	690	746
Exports of foreign antimony do	363	599	509	493	697
Stocks of antimony in bonded warehouse at end of year do	1,773	1,471	1,461	705	702
Production of antimony ore do	--------	86	--------	--------	--------
Antimony contained do	--------	42	--------	--------	--------
Antimony contained in antimonial lead produced from domestic and foreign ores short tons	2,736	3,432	3,052	1,685	964
Recovery of secondary antimony do	12,400	11,900	11,131	8,082	7,900

INTRODUCTION

Imports of regulus no longer represent available supplies of virgin antimony metal, as the new smelter at Laredo, Tex., began producing at the end of 1930. Imports of antimony metal were cut in half in 1931, following a drop of 30 per cent in the previous year. The depressed state of the market is also attested by a 38 per cent decline in the apparent consumption of babbitt metal and a drop of 29 per cent in the output of automobiles and trucks in 1931. These declines are all the more significant in that they followed declines of 35 per cent and 37 per cent, respectively, in these industries in 1930. The volume of actual sales was influenced further by the tendency for consumers to reduce their inventories, which may have been encouraged partly by the availability of domestic metal for prompt delivery, as compared with the former necessity of anticipating requirements several weeks ahead to allow for shipment from China. Economic pressure also tended to hasten the introduction of better melting practice with a view to reducing the wastage of the metal in printing establishments and foundries, thereby curtailing still further the demand for new metal.

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[1] Work on manuscript completed June, 1932.

[2] Unless otherwise stated, statistics in this report were prepared by H. M. Meyer, and data on imports and exports were compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

MARKETS AND PRICES

The downward trend in prices which commenced at the beginning of 1926 continued in 1931. During the first few months the price of standard Chinese brands held close to 7 cents a pound, duty paid at New York, and at times tended to go higher. American demand was at a low ebb, but European purchases were somewhat more liberal; Chinese supplies, although ample, were not overabundant. In March improvement in silver prices was a sustaining factor; but in April antimony came under the influence of the general weakness in the metal market, and by the middle of June Chinese metal was offered as low as 6 cents a pound. Bolstered by the announcement of President Hoover's moratorium plans for intergovernmental debt payments the antimony market recovered most of the ground that had been lost during previous months. At the mid year, however, speculators in Changsha were holding relatively large stocks of the metal, and an attempt to corner supplies had defeated its own purpose by stimulating output at the mines. During the latter half of the year the market drifted steadily lower, except for a brief reaction in November following a flurry in silver. Japanese military operations tended for a time to threaten the free movement of antimony both from Shanghai and from Changsha; but the price sagged listlessly, and at the end of the year spot metal was nominal at 6⅛ cents a pound, duty paid New York, and futures had dropped below 6 cents. This compares with an all-time record low price of 4.15 cents in March, 1922, when the import duty (10 per cent ad valorem) was only about ⅓ cent instead of 2 cents per pound as at present.

Cookson's "C" grade, which had been quoted in New York at 12⅞ cents per pound since early in May, 1930, dropped to 12 cents before the end of the first quarter, and beginning in July and to the end of the year was nominally around 11½ cents.

Needle antimony (powdered), as quoted by the Oil, Paint and Drug Reporter, was cut from 8½ to 6 cents a pound in July. Antimony oxide prices also sagged a little further, being quoted at 6½ cents at the end of the year. Prices of other antimony chemicals held remarkably well despite the meager demands.

Antimony ore was not quoted in American trade journals in 1931 as there were no sales. Even the London market was practically stagnant except for occasional transactions for continental account. Quotations for high-grade (60 to 65 per cent) ore were lower than in 1930, ranging from 3s. to 4s. throughout the year, and 50 per cent ore remained at 2s. 6d. to 3s. per long-ton unit. These quotations, which relate to metal content, were not increased when England suspended the gold standard.

The decline in sterling exchange resulted in a prompt rise of near £3 in the London price of Chinese metal; and by the end of the year there was a further increase to nearly £30 per ton, equivalent to

4½ cents a pound or almost 1 cent a pound lower than it had been 12 months before and close to the all-time record low price in 1921 (in gold equivalent). The only effect of the collapse of the pound on English brands was to narrow the range of quotations from £34 to £42 10s. early in September to £40 to £42 10s. per long ton during the last quarter.

New York quotations for recent years are summarized in the following table:

Prices of antimony (Chinese brands) per 100 pounds at New York City, 1913 and 1920–1931 [1]

Year	High	Low	Average	Year	High	Low	Average
1913	$9.250	$6.250	$7.520	1926	$23.750	$9.500	$15.988
1920	11.375	5.750	8.485	1927	15.000	10.750	12.393
1921	5.500	4.500	4.957	1928	11.375	9.500	10.305
1922	7.000	4.250	5.471	1929	9.750	8.250	8.956
1923	9.250	6.350	7.897	1930	8.875	6.750	7.667
1924	14.125	8.375	10.836	1931	7.625	6.050	6.720
1925	20.250	11.250	17.494				

[1] Compiled from Engineering and Mining Journal.

DOMESTIC PRODUCTION

As noted in the chapter of this series for 1930, the new smelter of the Texas Mining & Smelting Co. at Laredo, Tex., was started on December 31, 1930. The capacity of this plant, according to H. P. Henderson (private communication), is 3,600 tons a year of metal and oxide, and this could be quickly increased. Market conditions in 1931, however, did not justify full utilization of equipment already installed. Ore for this plant is imported from Mexico.

Except for 86 tons in 1928 no production of antimony ore in the United States has been reported since 1926. Substantial quantities of new antimony are recovered, however, at American smelters, more or less as a by-product of lead smelting. In former years the Bureau of Mines has reported the production of by-product antimonial lead in the United States from both foreign and domestic ores, including the antimonial lead imported from Mexico and refined in this country. For several years it has been the practice of certain primary smelters to add secondary metal to their smelting mixtures; but to calculate the new antimony supply of the United States the by-product antimony recovered from primary sources is reported as the smelter production of antimonial lead, whereas the antimony recovered at primary smelters from secondary sources is reported herein as secondary antimony. In 1931, for example, plants engaged principally in smelting and refining ore and bullion reported a total production of 21,842 tons of antimonial lead containing a total of 2,438 tons of antimony. Of the latter, however, 1,474 tons were secondary antimony, which leaves only 964 tons of primary antimony produced in antimonial lead in 1931, as compared with 1,685 tons in 1930. In 1929 much of the Mexican lead base bullion containing antimony that had formerly been shipped to the United States began to be refined in Mexico. During the 5-year period, 1924 to 1928, inclusive, for example, 28.3 per cent of the new antimony recovered in antimonial lead was of foreign origin; in 1930 the ratio dropped to 22.7 per cent; and in 1931 only 20.3 per cent of the antimony thus recovered was of other than domestic origin. The actual quantity of new by-product antimony from foreign sources dropped to 196 tons, compared with 383 tons in 1930 and an average of 773 tons annually from 1925 to 1929.

Mine production of antimony ores in the United States, 1921–1931, in short tons [1]

Year	Ore	Antimony content	Year	Ore	Antimony content
1922	20	4	1925	123	33
1923	40	10	1926	99	43
1924	113	33	1928	86	42

[1] No production reported for 1921, 1927, and 1929–1931.

At the Yellow Pine property in Valley County, Idaho, work was pushed, and a new 150-ton mill was completed. The ore to be treated in this pilot mill, which started producing early in 1932, contains 2 to 3 per cent of antimony and $8 to $9 in gold, and the antimony concentrates will be shipped at first to lead smelters in Utah. As this property is 80 miles from railroad transportation an electrolytic antimony plant may be installed when sufficient power becomes available. An additional hydroelectric development to provide 8,000 horsepower is being planned, and a 2,500-ton mill is also in prospect for treating lower grade ore, of which large tonnages are being developed. The following notes have been collated from an article by Stewart Campbell, on the Yellow Pine Enterprise, in the Du Pont Magazine (vol. 26, March, 1932, pp. 18–21):

> Marked progress was made in 1931 in developing the new mining district at Stibnite and Yellow Pine, Valley County, Idaho. The activities of the Yellow Pine Co., of which F. W. Bradley is president, are destined soon to become one of the largest mining operations in the United States. Mercury, gold, and silver, and electrolytic metallic antimony will be products. This formerly isolated district, too far from transportation to attract serious attention even during the World War, has lately been won from the wilderness.
>
> Gold was discovered in Thunder Mountain in 1889 or 1891 by Caswell Bros., and a good deal of prospecting for both gold and antimony was done in 1901–1903; but little work was done until 1918, when over a dozen companies were formed, acquiring practically all the properties. Even at war-time prices only a little hand-picked antimony and a few flasks of quicksilver were actually produced. Operations were discontinued after the armistice, and most of the properties were abandoned. J. J. Oberbillig, however, remained, and in January, 1921, organized the United Mercury Mines Co., which absorbed the holdings of the previous 12 companies. A good deal of promising development work was conducted, but it was apparent that many millions of dollars would be needed to provide transportation and prepare the district for profitable operation. In May, 1927, Oberbillig finally optioned the Meadow Creek and Cinnabar groups and in 1930 the antimony group to F. W. Bradley. Expenditures in 1930 exceeded those of any mining company in the State, and by spring of 1931 sufficient ore had been proved on Meadow Creek veins to indicate a future mine output of 2,500 tons a day. Metallurgical treatment has been satisfactorily solved, but as milling methods involved some new procedure a pilot plant of 150 tons was first projected and should be in operation in 1932. The holdings include:

Group	Number of claims	Principal metals
Meadow Creek	160	Gold, silver, antimony.
Hennessey	17	Do.
Antimony	80	Antimony, gold, silver.
Cinnabar	240	Mercury.
Yellow Pine		
Placer County	30	Placer gold.

In Alaska on the mainland about 15 miles west of Ketchikan a deposit of stibnite was being developed by the owner, Val Klemm. The property is on the east side of Point Camano about one-half mile from the shore of Bond Bay. The ore zone is said to be 3 to 4 feet in width and follows the limestone beside a schistose acid dike. A test shipment returned 44.8 per cent antimony, little arsenic, and no iron.[3] The following notes on antimony in Alaska are taken from the annual review of the United States Geological Survey:[4]

> Antimony minerals are widely distributed through Alaska; and the common antimony mineral, stibnite, is recognized in most of the mineralized areas in the interior. In the past antimony ore valued at more than a quarter of a million dollars has been mined in the Territory and sold. There has been little demand for this metal lately, and the market for it is said to be fairly closely controlled. As a consequence, there has been little interest in the search for deposits of this metal or development of those properties already known which might prove profitable if the ore were readily marketable.

SMELTER PRODUCTION OF ANTIMONIAL LEAD

By-product antimonial lead produced in the United States from both foreign and domestic ores, 1922–1931

Year	Short tons	Antimony content		Year	Short tons	Antimony content	
		Short tons	Value [1]			Short tons	Value [1]
1922	8,075	1,441	$156,000	1927	24,347	2,736	$675,800
1923	14,190	2,170	338,500	1928	33,058	3,432	707,000
1924	20,787	2,763	596,800	1929	25,669	3,052	545,700
1925	19,667	2,624	918,400	1930	13,711	1,685	258,500
1926	22,524	2,693	856,400	1931	(2)	964	129,600

[1] Calculated at average yearly price for ordinary brands of antimony as given by American Metal Market.
[2] Figures not available. Total by-product antimonial lead produced at primary plants from primary and secondary sources in 1931 was 21,842 tons.

RECOVERY OF SECONDARY ANTIMONY

During 1931, according to J. P. Dunlop, of the Bureau of Mines, the recovery of antimony from old alloys, scrap, and dross was 7,900 short tons, as compared with 8,082 tons in 1930. Of the 1931 total 1,474 tons were recovered from antimonial-lead scrap treated at regular smelters, and 6,426 tons were recovered as metal and in alloys at secondary smelters. In addition to the antimony recovered in metallic condition a considerable quantity of sodium antimonate was recovered at plants using the Harris process. This salt competes with antimony oxide for certain uses.

Secondary antimony and antimony content of secondary alloys recovered from old alloys, scrap, and dross in the United States, 1922–1931

Year	Short tons	Value [a]	Year	Short tons	Value [a]
1922	7,090	$765,700	1927	12,400	$3,060,300
1923	8,021	1,252,800	1928	11,900	2,451,400
1924	9,404	2,025,600	1929	11,131	1,990,200
1925	10,840	3,794,000	1930	8,082	1,239,800
1926	16,230	5,164,400	1931	7,900	1,061,800

[a] Values calculated at average yearly price for ordinary brands of antimony as published by the American Metal Market.

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[3] Engineering and Mining Journal, Develop Stibnite near Ketchikan: Vol. 132, No. 9, Nov. 9, 1931, p. 422.
[4] Smith, Philip S., and others, Mineral Resources of Alaska: Mineral Industry of Alaska in 1929, U. S. Geol. Survey Bull. 824, 1932.

Secondary metal is rapidly becoming an important factor in the antimony industry. Not long ago it was considered that antimony sold to a type foundry or to a bearing-metal manufacturer remained locked up in printing alloys or bearing metal until it disappeared. While it might be remelted a few times it had no more effect on the market for virgin metal than, let us say, an old pair of shoes has on the market for hides. However, this condition no longer exists; secondary smelters which purchase scrap and drosses from miscellaneous sources are now able to make standard alloys that can be used interchangeably with virgin metals for a variety of uses. Consequently, a relatively large quantity of antimony formerly considered as locked up in storage-battery plates, printing establishments, and babbitt and bearing metal may now be considered as a reserve stock of antimony.

In every large newspaper plant considerable quantities of linotype metal are remelted every day, and in the Government Printing Office in Washington the stock of lead-antimony alloys is generally about 700 tons. Better melting practice tends to reduce the amount of type-metal drosses sold by printing establishments and consequently affects the supply of raw material to secondary smelters. In many newspaper offices about 3 per cent of the metal charged to the melting pot is lost in remelting, the difference being made up by purchase of new antimony and lead. At the Government Printing Office, however, this loss has been reduced to an average of only about one-third of 1 per cent, and instead of buying virgin metals alloys of secondary origin are purchased. If similar economies were introduced at other large printing plants the demand for antimony would be correspondingly affected.

In recent years battery plates have been a leading source of secondary metal, as eventually about 75 per cent of all battery lead reappears on the market as scrap. According to the American Bureau of Metal Statistics, 83,000 tons of antimonial lead were used in storage batteries even in 1931, and in 1929 the quantity was 116,000 tons. In 1931 the average weight of antimony and lead (including lead in oxides) was 23 pounds per battery. The average life of an automobile battery is generally estimated as two years; formerly it was much less, and now it appears to be increasing. The antimony content of new plates ranges from 4 to 12 per cent, probably averaging nearly 7 per cent, but owing to admixtures of lead oxide and sundry impurities the plates yield by direct smelting a product containing only about 4 per cent of antimony. Such material has at times been a drug on the market, but it was in good demand during the early summer of 1931. Smelting charges were reduced from $28 or $29 a ton to $19 or $20, but early in October one of the largest consumers raised the rate to $23 a ton on monthly shipments of 50 or more tons, and $24 a ton for smaller shipments. The material is ordinarily purchased on the basis of lead content ("dry assay") plus the antimony content figured as lead at the New York price of lead less the smelting charge.

IMPORTS AND EXPORTS

Antimony imported for consumption in the United States, 1922–1931

Year	Antimony ore			Liquated antimony sulphide		Metallic antimony		Antimony oxides and other compounds	
	Short tons	Antimony content		Short tons	Value	Short tons	Value	Short tons	Value
		Short tons	Value						
1922				689	$40, 108	9, 344	$659, 242	379	$65, 538
1923	(1)	1, 047	$44, 721	835	64, 493	6, 763	641, 804	2, 277	288, 206
1924	(1)	899	62, 999	558	52, 393	6, 778	840, 434	1, 207	190, 252
1925	1, 359	773	47, 084	760	115, 990	9, 857	2, 362, 915	1, 792	349, 990
1926	2, 497	1, 559	287, 258	2, 040	343, 705	11, 506	3, 144, 330	2, 259	517, 584
1927	3, 566	2, 015	282, 098	1, 077	134, 949	9, 891	2, 111, 411	1, 803	484, 873
1928	3, 912	2, 185	313, 127	1, 208	158, 231	9, 684	1, 641, 265	2, 643	448, 156
1929	3, 161	1, 865	231, 086	1, 803	174, 104	11, 073	1, 622, 182	2, 222	359, 247
1930	1, 461	863	91, 499	713	45, 806	7, 700	883, 448	783	119, 314
1931	14, 015	4, 863	259, 952	650	30, 481	3, 753	357, 907	833	111, 500

[1] Figures not available.

Antimony imported into the United States, 1930 and 1931 [1]

[General imports]

Country	Antimony ore			Antimony metal [2]	
	Gross weight (short tons)	Antimony content		Short tons	Value
		Short tons	Value		
1930					
Argentina	731	489	$43, 962		
Belgium				273	$38, 227
Chile [3]	81	43	5, 921		
China [4]	308	194	16, 992	6, 628	654, 828
Germany				28	3, 213
Hong Kong [4]				34	3, 764
Mexico	341	137	24, 624	1, 402	175, 157
United Kingdom				141	27, 797
	1, 461	863	91, 499	8, 506	902, 986
1931					
Argentina	556	184	21, 801		
Belgium				3	504
China [4]				4, 836	396, 558
Germany				(5)	27
Mexico	13, 459	4, 679	238, 151	243	27, 656
United Kingdom				113	20, 624
	14, 015	4, 863	259, 952	5, 195	445, 369

[1] Includes large quantities of antimony metal that went into bonded warehouse and that are not included in the table of imports for consumption.

[2] Includes small quantities of liquated antimony sulphide, known in the trade as "crude antimony," "antimony matte," or "needle antimony."

[3] Imports credited to Chile originated mainly in Bolivia.

[4] Nearly all the imports of antimony ore and metal from Hong Kong are of Chinese origin. Some of the material credited to other countries is possibly also of Chinese origin, having been transshipped in a foreign port.

[5] Less than 1 ton.

Type metal [1] imported for consumption in the United States, 1922–1931

Year	Type metal		Assumed antimony content		Year	Type metal		Assumed antimony content	
	Short tons	Value	Short tons	Percentage		Short tons	Value	Short tons	Percentage
1922	22,448	$1,120,814	5,476	24.4	1927 [1]	439	$65,049	106	24.1
1923	[2] 3,677	431,610	(3)	(3)	1928 [1]	1,995	193,177	452	22.6
1924	[2] 644	100,367	(3)	(3)	1929 [1]	2,720	180,679	295	10.8
1925 [1]	3,005	463,134	850	28.3	1930 [1]	328	32,934	53	16.2
1926 [1]	4,311	912,331	784	18.2					

[1] Classification for 1925 to 1931 is "Type metal and antimonial lead"; separate figures not recorded. No imports reported for 1931.
[2] Lead content only. Figures for gross weight for 1923 and 1924 not available.
[3] Data not available.

Foreign antimony (matte, regulus, or metal) exported from the United States, 1922–1931 [1]

Year	Short tons	Value	Year	Short tons	Value
1922	19	$1,548	1927	363	$72,280
1923	8	1,047	1928	599	90,975
1924	140	14,441	1929	509	71,415
1925	94	17,376	1930	493	54,634
1926	184	41,554	1931	697	74,668

[1] During 1922 there was also exported, mainly to Canada, 112 tons of regulus or metal of domestic manufacture, valued at $13,961. This is the first export of domestic antimony of which there is any record. However, antimony manufactured in the United States from foreign ores and exported would also be classed as domestic exports. Similar exports for 1923–1931 are not shown.

TECHNOLOGY

According to Dr. H. Wahlwill, who lectured on electrolysis before a meeting of the German Metal Smelting and Mining Association in Berlin in September, 1931,[5] a Russian process has been developed for recovering antimony from solutions of its sulphides in an alkaline bath, but it is doubtful whether this method can compete with fire methods. At the Norddeutsche Affinerie, however, electrolytic antimony has been made for a number of years, and elsewhere electrolytic methods may be economical for the treatment of complex ores which can not readily be separated in the dry way.

In Australia a practical demonstration was held at Melbourne on December 8, 1931, to examine the process patented by Dr. H. W. C. Annable of the Ferro Alloy (Ltd.), Port Elizabeth, South Africa (British Patent 347680, January 27, 1930), for the treatment of antimonial gold ores. By roasting the sulphide ore or matte with suitable fluxes (such as sodium sulphate, alum, or common salt and sulphuric acid) at a low temperature (starting at 100° to 150° C. and finishing at not to exceed 450° to 500° C.) and then leaching with cold water, it is claimed that all the sulphur can be eliminated. Although hitherto it has been possible to produce a "sweet roast" in the laboratory, it has been almost impossible to do so on a commercial scale, but according to reports [6] this is now possible by the new process. Gold is recovered from the leached residue by ordinary amalgamation or cyanide processes, and the antimony may then be recovered by smelting. Some antimony can also be recovered from the leaching liquor by agitating it with milk of lime or magnesia and heating it to hasten precipitation.

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[5] Mining Journal (London), vol. 67, Jan. 30, 1932, p. 72.

According to a German article [7] antimony trioxide (Sb_2O_3) should not be used in enamels employed for cooking utensils as the antimony can be extracted therefrom by dilute acids. Tests have shown that if the pentoxide (Sb_2O_5) is used no antimony is dissolved in dilute acids, and danger of food poisoning may be avoided.

TARIFF

Late in 1931 the United States Tariff Commission received an application from the Texas Mining & Smelting Co. for higher duties on antimony oxide and on the metal, both of which carry a duty of 2 cents a pound, but the petition was denied on January 18, 1932.

WORLD PRODUCTION

The world consumption of new antimony, exclusive of the antimony content of antimonial lead, reached a peak of about 50,000 tons during the World War, but later it dropped to below 20,000 tons and then rose to more than 30,000 tons in 1929. In recent years China has been the dominant source of supply, furnishing at times over 75 per cent of the total output. Bolivia, Mexico, France, and Czechoslovakia, more or less in the order named, are next in importance, although they furnish in the aggregate usually less than 25 per cent of the world output. Smaller quantities of antimony are produced annually in a number of other countries. Outside of China the pace of production is usually influenced strongly by prices, but in 1931 it is noteworthy that despite the continued recession in price levels production in Mexico advanced and that plans for placing Canada in the list of producing countries were being carried out.

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[6] Industrial Australian and Mining Standard, Treatment of Antimonial Ores: Vol. 86, Dec. 17, 1931, p. 403.

[7] Melzer, Hans, Antimony in Enamels: Glashütte, vol. 59, 1929, p. 865; Chem. Abs., vol. 25, No. 14, July 20, 1931, p. 3792.

World production of antimony, 1923–1931, in metric tons [1]

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [2]	1923	1924	1925	1926	1927	1928	1929	1930	1931
North America:									
Canada	--------	--------	--------	--------	3	--------	--------	--------	6
Mexico	[3] 490	[3] 775	935	1,783	2,098	2,297	[3] 2,709	[3] 3,032	4,354
United States	8	24	24	31	--------	30	--------	--------	--------
South America:									
Argentina	[3] 5	[4] 120	[3] 10	(5)	--------	--------	--------	--------	--------
Bolivia [3]	312	621	1,384	3,503	3,214	2,834	3,023	927	1,078
Peru	--------	--------	14	79	89	112	[3] 86	[3] 47	[3] 24
Europe:									
Austria	62	1	--------	87	857	914	560	--------	(6)
Czechoslovakia	453	1,066	535	938	1,586	967	556	307	(6)
France	691	964	1,027	586	714	925	1,021	1,106	516
Greece	--------	--------	--------	--------	--------	--------	55	54	(6)
Italy	271	372	312	360	285	230	306	330	269
Portugal	8	14	15	--------	--------	--------	--------	--------	(6)
Spain	25	--------	--------	14	10	6	--------	--------	(6)
Yugoslavia	131	414	139	182	279	258	210	3	68
Asia:									
China [3]	14,256	12,059	19,496	20,926	17,986	19,324	22,401	17,419	9,842
India, British	--------	--------	5	53	244	181	38	1	(6)
Japan	--------	10	--------	--------	--------	21	22	--------	(6)
Turkey (Asia Minor)	--------	--------	59	--------	20	78	6	26	(6)
Africa:									
Algeria [3]	500	905	1,461	334	442	21	114	--------	282
Morocco, Spanish	--------	--------	--------	[3] 70	[3] 94	[3] 225	[3] 180	--------	80
Nigeria [3]	(7)	--------	--------	--------	--------	--------	--------	--------	(6)
Southern Rhodesia	--------	--------	15	24	--------	40	--------	27	--------
Oceania:									
Australia—									
New South Wales	--------	--------	12	34	51	48	25	42	14
Queensland	--------	--------	--------	3	2	1	--------	--------	--------
Victoria	421	130	54	--------	--------	1	1	(6)	(6)
Western Australia [3]	--------	--------	--------	(8)	--------	--------	--------	--------	--------
	17,600	17,500	25,500	29,000	28,000	28,500	31,300	23,300	(6)

[1] Approximate recoverable metal content of ore produced (80 per cent of reported content), exclusive of antimonial lead ores.

[2] In addition to the countries listed antimony ore is reported produced in Siam, Chosen, and French Morocco, as follows: Siam, 9 tons of ore in 1924; Chosen, 21 tons of ore in 1926 and 15 tons in 1927; and French Morocco, 120 tons in 1928. As no information is available on the antimony content of these ores, the figures have not been included in the table.

[3] Exports.

[4] Shipments. A large part of the shipments reported is probably of Bolivian origin and therefore may duplicate in part the quantities shown for Bolivia.

[5] Less than 1 ton. Estimated recoverable content of shipments in 1926 was 55 kilograms.

[6] Data not available.

[7] Less than 1 ton. Estimated recoverable metal content of ores exported not stated.

[8] Less than 1 ton. Estimated recoverable metal content of ores exported in 1926 was 464 kilograms.

ARGENTINA

Antimony is found at San Pedro in the Province of Jujuy where a small smelter is located; but because of high production and transportation costs it can not be worked profitably at present prices, and there was no 1930 production. Domestic requirements are less than about 100 tons a year, not enough to justify domestic production in spite of a high import duty for protection of the industry.[8] When war prices prevailed the production of antimony ore reached 2,000 tons, but operations have practically ceased since that time.

A bulletin of the Argentine Government reports antimony veins in Pliocene slate in the northern part of the San Antonio de los Cobres in the northeastern part of Los Andes, where both stibnite and antimony ocher have been found. Stibnite, probably auriferous, has been reported from Sierra de Córdoba close to Higera, Province of Córdoba, and quartz veins containing antimony also exist in Quebrada de Sebila in the southwestern part of the Province of Catamarca where a small quantity has been produced.

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[8] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes: No. 337, May 16, 1931, p. 2.

AUSTRALIA

Antimony mining in Australia was at a low ebb in 1931. The gold-antimony veins of Costerfield, Victoria, were recently described by Stillwell.[9] Occurrences at four localities (Mallina, Peewah, Sherlock Crossing, and Mount Negri) in Western Australia are mentioned in a pamphlet published in 1931 by the Government mineralogist,[10] but production from these territories has never reached significant proportions. The sulphide ore of the west lode, Wiluna Gold Mines, contains varying quantities of antimony, principally in the form of stibnite, but apparently no plans have been made to recover an antimonial product therefrom.

BRITISH INDIA [11]

Stibnite lodes, carrying 6 dwts. of gold per ton, occur in gneissose granite in Punjab, stibnite with cervantite occurs in the northern Shan States, and the Sleemanabad copper lodes are highly antimonial (tetrahedrite). In Burma about 1,000 tons of antimonial lead are produced annually; it analyzes 77 per cent lead, 21 per cent antimony, and 6 to 8 ounces silver per ton.

CANADA

Antimony ores occur in the Provinces of Nova Scotia, New Brunswick, and British Columbia, and in the Yukon, and sometimes antimony is recovered from the cobalt ores of Ontario. In 1931 the Lake George mine of New Brunswick made a test shipment of 25 short tons of antimony ore to Liverpool, England.[12] A small concentrating plant may be erected at this property. Recent developments are described as follows:[13]

> The antimony deposits at Lake George in York County are owned by the Canadian International Co. (Ltd.) and the Lake George Mines (Ltd.). The Canadian International Co. owns the larger property, which produced most of the ore mined in the past, but they have not made any determined attempt to carry on development. The Lake George Mines (Ltd.) began operations in 1929 and have continued until the present time.
>
> In the summer of 1931 the Department of Lands and Mines, Fredericton, made a detailed plane-table map of the district, located all of the known pits and shafts, and assisted by the Lake George Mining Co. made a transit survey of the underground workings on the Lawrence vein. The extensive underground workings of the other property are flooded and inaccessible. The field work was carried on by Prof. S. C. Perry, of the University of New Brunswick, who hopes to complete a detailed study of the geology and mineralogy, and the following information is based largely on his maps and notes.
>
> From the data mapped last summer, it is evident that the several veins at Lake George have been traced by pits, shafts, and underground workings for a distance totalling approximately 2 miles, and surface indications suggest that the total length of all the veins may be as great as 4 miles.

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[9] Stillwell, F. L., The Gold-Antimony Veins of Costerfield, Victoria: Australian Inst. Min. and Met. (Inc.) Proc., new series, No. 48, Melbourne, Sept. 30, 1931, pp. 355–380.

[10] Simpson, E. S., Antimony: Mineral Resources of Western Australia (Publicity Booklet).

[11] Pascoe, E. H., Quinquennial Review of the Mineral Production of India for the Years 1924 to 1928: Records Geol. Survey India, vol. 64, 1930, pp. 26–28.

[12] Dominion Bureau of Statistics, Preliminary Report on the Mineral Production of Canada during the Year 1931; Ottawa, 1932, p. 16.

[13] Wright, W. J., Lake George Antimony Deposits: Canadian Min. and Met. Bull. 234, October, 1931, p. 1200.

CHINA[14]

In 1931 China exported 8,792 metric tons of regulus, 1,134 tons of crude, and 576 tons of oxide as compared with 16,023 tons of regulus, 2,326 tons of crude, and no oxide in 1930. Although the exports of regulus dropped 45.1 per cent the actual output, according to preliminary reports, did not decline to anything like the same extent. Such shrinkage in production as did occur was due more to lack of demand abroad than to local factors. Conditions in Hunan, the principal producing Province, were more settled at the end of the year than for some months previous. Bandit activity, which has impeded operations more or less seriously in previous years, was checked in the latter part of 1930 and gave little trouble during the year under review. Antimony is mined in two separate districts in Hunan, and both of them were virtually out of the flooded area. Sino-Japanese relations at the end of the year likewise failed to have an adverse influence upon the mining or transportation of antimony.

In a previous section of this chapter mention is made of the attempt by local speculators during the second quarter of the year to corner the Changsha market, but this combine collapsed during the third quarter. Although business with Europe was better than with the United States demand did not keep step with supply, and the downward drift of prices discouraged the building up of heavy stocks. At the end of June 2,800 long tons of regulus were said to be in possession of these speculators.

The effect of exchange on the Chinese antimony industry is not often clearly indicated; but it is worthy of note that the Hankow price of about $314 (Mexican) a long ton at the end of 1931 compared favorably with the price in February, 1930, whereas in terms of American dollars there was a difference measured by a decline in two years from about $105 to $73. Owing to taxes, freight, and other charges, the Hankow price is about $56 a long ton higher than the price at Changsha.

In 1927 nearly 7 per cent of the Chinese output was from Provinces other than Hunan—mainly from Kweichow, Kwangtung, and Kwangsi—but in subsequent years production in these Provinces apparently has declined to negligible proportions. Many of the minor districts are handicapped by high transportation costs and can not operate when prices drop to the levels of recent years.

CZECHOSLOVAKIA[15]

The known antimony deposits in the Erzgebirge in the eastern part of Czechoslovakia have been acquired recently by a single company with a view to mining and smelting antimony on a moderately large scale. The principal property of this company is the large occurrence north of Rosenau extending about 30 kilometers east-northeast along the Schmöllnitz Valley. The company operates mines at both Tschutschma and Spisska Bana, but the course of this series of antimony veins is marked by old workings all the way from Polomo and Betler on the Rosenau-Dobschau Railroad to the southwest and northeasterly to beyond Tinesgrund. Some of the old dumps have yielded samples assaying 16 to 27 per cent antimony.

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[14] Compiled mainly from reports of U. S. Vice-Consul James B. Pilcher, Hankow.

[15] Lambrecht, Willy, Über den Antimonit—Bergbau im slowakischen Erzgebirge: Metall. u. Erz., vol. 28, No. 14, July 2, 1931, pp. 341-348.

Antimony occurs as stibnite associated with copper and other sulphides and gold in a complex of metamorphic rocks. The ore at Tschutschma contains arsenic; gold is also present in varying amounts, frequently associated with the arsenic. A sample of concentrates analyzed 39.58 per cent antimony, 7.74 per cent arsenic, 16.8 grams per metric ton silver, and 104.0 grams per metric ton gold; but the ore as mined generally runs only 10 to 20 grams per ton in gold, and the gold is not recovered.

The Vajskowa smelting works are situated some distance west of the Tschutschma-Spisska Bana vein system and were formerly supplied with ore chiefly from an entirely different series of deposits which follow a general north-south trend. These earlier mining operations centered about Lom and were fairly extensive. This second series of deposits continues in the northern Dubrawa district where three veins were worked as early as 1806 and as recently as the World War. Old records indicate that veins that were rich in antimony were poor in gold and vice versa.

At Tschutschma mining has progressed to a depth of 300 meters. As much as 5,000 tons of ore have been extracted from the Gabriella mine in this district in one year. Other mines, including the Neu-Vinze to the west, are no longer accessible. The bulk of the output now comes from the Spisska-Bana district where operations were resumed a few years ago. The old workings were in the valley of the Stoffgrund, a tributary of the Göllnitz, west of the village of Einsiedel (Szepesremete). Two new tunnels have been opened up at the same level as the old ones. Several veins, more or less badly faulted, have been opened up, mainly in slate; and in places the solid ore is 1.5 meters thick and the vein width 4.5 meters, although elsewhere the vein is only 0.80 meter thick. The ore in this district is higher grade than at Tschutschma, averaging 18 to 24 per cent antimony, and is practically free from arsenic and copper. The disseminated ore, found mainly in the footwall, is not mined at present owing to lack of proper concentrating equipment.

Electric power is available at Spisska Bana and may later be carried to Tschutschma by long-distance transmission line. Compressed-air drills are used, compressors being driven by a 130-hp. Diesel engine at Tschutschma and by a 100-hp. wood-burning steam installation at Spisska Bana. Concentrating plants comprising crushing, screening, and hand-sorting arrangements supplemented by jigs are found at both mines, but no attempt is made to save all the values. The Tschutschma plant, which handles about 32 tons of mine material in eight hours, produces about 7 tons of concentrates with 53 to 55 per cent antimony. The tailings contain 4 to 7 per cent antimony which later may be recovered by flotation. At Spisska Bana a 58 to 60 per cent concentrate is made, and 50 per cent of the tailings are stored for further treatment.

As much as 1,050 tons of regulus have been produced annually at Vajskowa in recent years. The plant comprises four wood-fired furnaces, each capable of handling a 500-kg charge in four hours. The slag is said to contain 10 per cent antimony, and the following analyses are given of the concentrates charged and the regulus produced according to the origin of the ore:

	Tschutschma		Spisska Bana	
	Concentrates	Regulus	Concentrates	Regulus
	Per cent	*Per cent*	*Per cent*	*Per cent*
Sb	53.00–57.00	99.03	57.00–60.00	99.52
As	.20–.30	.3–.4	Trace.	.08
S	23.00–27.00	.18	25.00–27.00	.21
Fe	1.00–1.50	.16	Trace.	.15
Pb	Trace.	.10	.10–.20	.02
Cu	Trace.	.08	Trace.	.02

FRANCE

In 1930 France produced 5,120 metric tons of antimonial ores, an increase of 380 tons compared with the previous year, but in 1931 the output was cut almost in half. In the Cantal district only 454 metric tons of antimony were produced in 1931—800 tons less than in 1930. There are 14 concessions in this area, of which only 4 are exploited—La Licoulne, Chazelles, Moulergues, and La Chassagne. The ore is treated at Brioude and Massiac works where oxide and metal are produced.[16] Imports of ore increased in 1931, and the imports of regulus (about 1,100 tons) were only a little less than the figures for the previous year. On the other hand, domestic production of the metal, mainly at the Lucette works in the Department of Mayenne, was said to be substantially less than imports, whereas in former years France has found it profitable to produce the bulk of her domestic needs.

GERMANY

A number of antimony deposits have been worked in Germany; but German production has never been very large, and the country, although maintaining an antimony smelting industry, has almost invariably been forced to import both ore and metal far in excess of its exports of antimony products. In the chapter of this series for 1928 mention was made of the discovery of a deposit of 28.4 per cent antimony ore near Wolfersgrün in Upper Franconia. Antimony mines elsewhere in this region were worked until 1917. The newly discovered occurrence has subsequently been described by Hundt.[17]

JAPAN

The principal antimony deposits in Japan are situated in the small island of Sikoku, north and south of Yechine and near Nara. In 1894 stibnite was discovered at Ichinogawa near Besshi in the northern part of this island, and 162 tons of metal were produced there in that year. Ores of similar character are still exploited at Totsugawa, Kochi, and Oita. Production of the metal reached 825 metric tons in 1897 but has since declined to only 200 or 300 tons a year.

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[16] Metal Bulletin (London), Sept. 1, 1931, p. 13.

[17] Hundt, R., Antimonerzfundstelle in Ostthüringen und Oberfranken: Bergtechnik 22, 1929, p. 62; Abs., Neues Jahrb., Ref. 11 (1); vol. 15, 1931; Annotated Bibliography of Economic Geology for 1931, vol. 4, No. 1, January, 1932, p. 57.

RUSSIA

A discovery of antimony-mercury ore at Khaidarkansk near southern Ferghana in Tadzhikistan (Turkestan) was announced in 1931.[18] The deposits extend 16 kilometers and are deemed an important source, especially of mercury. Antimony and molybdenum deposits near Novotroitsk on the Unda River, Transbaikalia, are also noted.[19]

BIBLIOGRAPHY

BRODERICK, S. J., and EHRET, W. F. An X-ray study of the alloys of silver with bismuth, antimony, and arsenic. Part I, Jour. Phys. Chem., vol. 35, September, 1931, pp. 2627–2636. Metals and Alloys, vol. 3, No. 1, January, 1932, p. MA 8.

The maximum solubility of bismuth in silver is stated to be about 5.5 per cent; that of antimony in silver, 6 per cent.

CHEMICAL AGE (LONDON). Solidification of lead-antimony alloys. Vol. 24, Feb. 7, 1931, p. 10 (of Monthly Metallurgical Section).

The belief that lead-antimony alloys of the kind to which type metals belong expand on solidification dies hard, seeing that it is repeated in a comparatively recent book on alloys. It certainly dates back to the fifties of the last century and in a once popular work, "Muspratt's Chemistry," is set out explicitly as follows: "The chief use of antimony in making stereotype plates is that, besides hardening them, it causes expansion of the alloy in cooling and as the cooling next the type is latest, the expansion causes the metal to fill every interstice, and beautifully sharp casts result." The article on antimony in which this passage occurs is unsigned, but the contributors to "Muspratt" were among the best-known chemists and metallurgists of the day, and the passage quoted is interesting due to the fact that one part of the explanation of something that actually does not occur is in itself very near the mark as to what does occur. Yet J. A. Smythe, in his monograph on "Lead," also makes a similar misstatement in a sentence containing, once again, a half truth, when he says (p. 222) "The expansion on solidification" (of antimony-lead alloys) "is a maximum at the eutectic composition." As a matter of fact, while bismuth-lead and bismuth-tin alloys do expand on freezing (or somewhere so near that point as hardly to affect the argument), lead-antimony alloys do not. Now, in earlier times bismuth used to be a constituent of type metals, although for many years its use has been abandoned in making those alloys. The erroneous notion may be a survival of the type founder's actual experience of type metal containing alloys which did actually expand on freezing, but this is not a justification for the belief, which still survives in the type foundry, that present-day type metal alloys behave in this manner.

CLENNELL, J. E. The estimation of antimony and arsenic. Min. Mag. (London), vol. 45, Nos. 3 and 4, September, 1931, pp. 151–153; October, 1931, pp. 211–218.

CRENNELL, J. T., and MILLIGAN, A. G. The use of antimonial lead for accumulator grids: a cause of self-discharge of the negative plates. Trans. Faraday Soc., vol. 27, 1931, pp. 103–112. Chem. Abs., vol. 25, No. 10, May 20, 1931, p. 2372.

ENGELHARDT, V. The electrolytic extraction of sulphide antimony ores. Ztschr. Electrochem., vol. 11, 1931, pp. 813–814. (cf. Izgaruishev and Pletenev, Chem. Abs., vol. 25, p. 5352). Chem. Abs., vol. 26, No. 5, Mar. 10, 1932, p. 1195.

GODIN, H. The advantages of lead-antimony and lead-antimony-cadmium alloys over lead in the manufacture of sheaths for telephone cables. Rev. univ. mines (8), vol. 5, 1931, p. 106. Chem. Abs., vol. 25, No. 10, May 20, 1931, p. 2403.

HERTEL, EDUARD, and DEMMER, ARTHUR. Compression diagrams and temperature-hardness curves of some lead-tin-antimony alloys. Metallwirtschaft, vol. 10, No. 7, 1931, pp. 125–126. Chem. Abs., vol. 25, No. 9, May 10, 1931, p. 2101.

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[18] Metallbörse, Die Antimon- und Quecksilber—Vorkommen im Ferghana Gebiet: Vol. 21, No. 54, Berlin, 1931, p. 1279 (from Sowjetwirtschaft u. Aussenhandel).

[19] Saukov, A. A., Antimony and Molybdenum Deposits near Novotroitsk on the Unda River, Transbaikalia: Acad. Sci. U. S. S. R. Compt. Rend. 1930A, No. 13, 345–349; Chem. Abs., vol. 25, No. 6, Mar. 20, 1931, p. 1186.

Isgarischev, N. A., and Pletenev, S. A. Production of metallic antimony from its ores by electrolysis. Ztschr. Electrochem., vol. 37, 1931, pp. 363–365. Chem. and Ind. (London), vol. 50, No. 38, Sept. 18, 1931, p. 846.

Massive deposits of antimony may be obtained by electrolysis of a solution of Sb_2S_3 in 10 per cent NaOH using an iron cathode, and if the cathode deposit is protected from polysulphides formed at the anode by enclosing the latter in a porous membrane and adding KCN the current yield may average 75 per cent. Small amounts of arsenic in the electrolyte do not separate with the antimony. The process is continuous, the electrolyte alternately passing through the cell and over the leached ore, thus being constantly regenerated.

Iwase, K., and Aoki, N. Equilibrium diagram of the ternary system of tin, lead, and antimony. Kinzoku no Kenkyu, May, 1931, pp. 253–267. Metals and Alloys, vol. 2, No. 5, November, 1931, p. 249.

Kroll, W. Vaporization of antimony in a converter. Metall u. Erz, vol. 28, 1931, pp. 521–523. Chem. Abs., vol. 26, No. 5, Feb. 10, 1932, pp. 676–677.

In a specially constructed iron retort it was found possible to vaporize over 50 per cent of the antimony from a copper-antimony slag by heating at 600° in a vacuum, but this is hardly a suitable commercial method.

Kuhl, Hugo. Enamel containing antimony for cooking utensils. Glashütte, vol. 60, 1930, pp. 886–887. Jour. Am. Ceram. Soc., vol. 15, No. 1, January, 1932, p. 11.

In most enamels antimony exists in its trivalent state, which is the most stable. The pentavalent compounds are converted into trivalent compounds by the loss of oxygen during fritting (long firing or high temperatures). Three per cent solutions of tartaric acid or 4 per cent acetic acid dissolve antimony from enamels in very small quantities.

Maier, C. G., and Hincke, W. B. The system $PbO\text{-}Sb_2O_3$ and its relation to lead softening. Am. Inst. Min. and Met. Eng., Tech. Pub. 449, February, 1932, pp. 1–12.

Metal Industry (London). Type metal. Modern system of production from scrap alloys. Vol. 39, No. 21, Nov. 20, 1931, p. 490.

St. John, H. M. The influence of impurities in foundry brasses and bronzes. Metals and Alloys, vol. 2, No. 4, October, 1931, pp. 242–245.

In the foundry alloys antimony produces brittleness but can be substituted for part of the tin if no great strength or ductility is needed. The powerful effect of antimony on the structure of copper, and presumably of the copper alloys, may be inferred from the fact that 0.06 per cent antimony raises the recrystallization temperature of pure copper 75° C. Less than 0.2 per cent antimony has a very noticeable effect on the structure of a foundry brass containing 10 per cent lead.

Schmidt, Hans. Antimony in drug synthesis. Ztschr. angew. Chem., vol. 43, 1930, pp. 963–970. Chem. Abs., vol. 25, No. 3, Feb. 10, 1931, p. 557.

Scott, J. Antimony in type metal. Its value in modern printing. "Caxton Mag.," vol. 33, No. 3, pp. 138–140. Metal Ind. (London), vol. 38, No. 18, May 1, 1931, p. 462.

Shakhov, G. A., and Slobodska, Ya. Ya. Study of processes for obtaining antimony and its oxides from ores. Tzvetnuie Metallui, 1930, pp. 1294–1323; Chem. Abs., vol. 25, No. 15, Aug. 10, 1931, p. 3940.

To study the conditions of roasting of antimony sulphide, the authors determined the curves of volatility, oxidation to Sb_2O_3 and Sb_2O_4, and dissociation of Sb_2O_4 as a function of temperature. Sb_2S_3 begins to volatilize at about 650°; the reaction is rapid at 800°–850° and is complete at 917°. Oxidation of Sb_2S_3 to Sb_2O_3 begins at 190°, takes place rapidly at about 340°, and is complete at 445°; above the latter temperature Sb_2O_3 is oxidized to Sb_2O_4. Dissociation of Sb_2O_4 into Sb_2O_3 and O takes place at about 900° and is complete at 1,030°. Preparation of antimony by fusing the sulphide with iron is advisable for rich ores. The fusion temperature is 1,100°–1,500°; the use of a lower-melting charge reduces the volatilization losses. The reaction should be carried out in a reducing atmosphere, and the dust in the gases should be recovered. The yield of antimony is about 90 per cent. With poorer ores (20 to 39 per cent Sb) and ores containing precious metals, the sulphide should be roasted to the volatile Sb_2O_3; with rich or concentrated ores and in the absence of precious metals, arsenic, and lead, it is preferable to roast to Sb_2O_4.

Vogel, F. Electrolytic production of antimony. Metallbörse, vol. 20, 1930, pp. 537–538, 650–651. Chem. and Ind. (London), vol. 50, No. 2, Jan. 9, 1931, p. 25.

A solution containing sulphuric acid (100–160 g), hydrofluoric acid (20 g), and antimony (200 gpl) may be used. The anodes (95–97 per cent Sb) may contain lead, tin, iron, nickel, zinc, copper, bismuth, and the noble metals as impurities.

Wang, H. C., Hsu, Y. T., and Hsiu, H. C. Report on the Chang-Chen-Ling antimony mine, I-Chang-Hsien, Hunan: Hunan, Geol. Survey, Bull. 10, October, 1930, pp. 12–13.

A replacement deposit of stibnite in the Wan-Lo-Shan limestone (probably lower Carboniferous?). Some oxidized antimony products are present.

Williams, J. R. New process for treating antimony ores. South African Min. and Eng. Jour., vol. 41, Pt. II, 1931, pp. 495–496. Chem. Abs., vol. 25, No. 16, Aug. 20, 1931, p. 4211.

Untreated antimony-gold ore from the Murchison Range, Transvaal, is not amenable to amalgamation or cyanidation. A special calcination volatilized the antimony and arsenic, after which 74.44 per cent of the gold was recovered by amalgamation and 15.66 per cent by cyanidation.

Yap, Chu-Phay. A thermodynamic study of the equilibria of the systems antimony-bismuth and antimony-lead. Am. Inst. Min. and Met. Eng., Tech. Pub. No. 397, February, 1931, pp. 1–24.

PATENTS

Abel, Emil (to Jacob Neurath). Bearing alloy. U. S. Patent 1795633, Mar. 10, 1931. Chem. Abs., vol. 25, No. 10, May 20, 1931, p. 2410.

Aluminium-Industrie, A.-G. Aluminum alloys. British Patent 337922, Oct. 12, 1928. Chem. Abs., vol. 25, No. 9, May 10, 1931, p. 2108.

Elongation and bending and rolling capability of sheets, bands, wires, etc., of Al alloys of high tensile strength is improved by plating them with an Al alloy of lower tensile strength but of high elongation and good bending and rolling capability, such as one containing Mn 1–4, Mg 0.5–6 per cent and up to 1 per cent Sb, or one containing Mn 0.5–2, Mg 0.3–1 and Si 0.5–2 per cent or up to 2 per cent of Pb. Various details of manufacture are given.

Annable, H. W. C., and Ferro Alloy Co. of Africa (Ltd.), (Proprietary), of Port Elizabeth, South Africa. Treating antimony ores. British Patent 347680, January 27, 1930. Chem. Age (London), vol. 25, No. 631, Aug. 1, 1931, p. 12.

To separate gold and antimony from sulphide or other ores of antimony the ore or matte is mixed as a finely crushed concentrate with a flux such as niter cake, salt cake, an alkali metal bisulphate, magnesium sulphate, aluminum sulphate, soda or potash alum, sodium sulphate and sulphuric acid, or common salt and sulphuric acid, and the mixture is roasted with a regulated supply of air; the mass is then leached with water, and the residue is treated by known methods for recovery of the gold. Thus 1 part of a concentrate containing the gold as metal or as sulphide, arsenide, telluride, selenide, etc., may be mixed with 2 parts of the flux and the mixture be charged into a furnace at 100°–150° C. and roasted until all the sulphides, arsenides, and antimony are oxidized, the final and maximum temperature of tne mass being not above 450°–500° C. The cooled mass is agitated in cold water, and the insoluble residue is collected on a filter. To insure a high recovery of gold by use of mercury the residue should be slimed before or during amalgamation. The water-insoluble portion after removal of the amalgam may be treated for extraction of the antimony, for example, by drying and reducing with fluxes to give a regulus. Some antimony is also recoverable from the leaching liquor by agitating it with milk of lime or magnesia and heating to effect a rapid precipitation.

Berg, Antimon Hüttenwerke, A.-G. Antimony oxide. French Patent 706371, Nov. 25, 1930. Chem. Abs., vol. 26, No. 1, Jan. 10, 1932, p. 264.

Industrial oxide of antimony is obtained by the oxidation of antimony concentrates (purified antimony ores) which have been mixed with a suitable amount of residual oxide from a previous oxidation.

Contal, C. Oxidation-resisting alloys for valves, etc., exposed to steam. British Patent 346226, June 21, 1929. Chem. Abs., vol. 26, No. 2, Jan. 20, 1932, p. 417.

An alloy is used containing Ni 40–50, Cu 30–40, Mn 10–20, Sb 5–15, and Sn 1–10 per cent, with or without a small proportion of lead. Various details of producing the alloys are described.

Davis, Philip W. Refining lead from scrap storage-battery plates. U. S. Patent 1809835, June 16, 1931. Chem. Abs., vol. 25, No. 17, Sept. 10, 1931, p. 4513.

The scrap material is heated in a furnace so that the lead alloy and the lead oxides contained in the battery plates are melted in intimate contact with each other in small masses and flow downward into the bottom of the furnace, and the heating is continued until a body of refined lead containing only a small percentage of antimony is collected; this purified lead is drawn off, reducing material is introduced into the furnace, and heating is continued to smelt the lead and antimony content of the oxide material into a lead-antimony alloy comparatively high in antimony; and this alloy is drawn off.

Deutsche Schmelz und Raffinierwerke, A.-G. Antimony trioxide. British Patent 345034, Feb. 6, 1930. Chem. Abs., vol. 26, No. 1, Jan. 10, 1932, p. 264.

Pure amorphous antimony trioxide is produced by heating, at its upper surface only, a stationary charge of antimony, or mixtures adapted to yield the oxide on roasting, and treating the heated mass (suitably at 1,000°) with air diluted with inert gases such as combustion gases from a directly-heated muffle or closed-flame furnace which may be used.

Enslen, J. E., and Stein, F. Antifriction alloy and its production. Hungarian Patent 101303, May 14, 1928. Chem. Abs., vol. 25, No. 10, May 20, 1931, p. 2410.

Fonderie de Precision Alliages et Procedes "Zenith" and Adrien Desgranges. Alloy for soldering. French Patent 701961, Dec. 11, 1929. Chem. Abs., vol. 25, No. 15, Aug. 10, 1931, p. 3954.

The alloy contains, for example, Zn 52–72, Cu 1–2, Al 2–3, Sn 27–37, Cd 1–2, and Sb 0.5–2 per cent.

Goldschmidt, Th. A.-G. Bearing metal alloys. German Patent 531631, Dec. 28, 1921. Chem. Abs., vol. 26, No. 1, Jan. 10, 1932, p. 75.

The alloy described in 408229, containing 70–75 per cent lead, 15–25 per cent antimony, 3–6 per cent tin, 1–3 per cent nickel, and 0.6–1.5 per cent copper is improved by addition of small quantities of iron, manganese or metals of the chromium group. The nickel may be replaced partly or wholly by cobalt.

Hanak, Albert. Separating antimony from lead alloys. U. S. Patent 1786908, Dec. 30, 1930. Chem. Abs., vol. 25, No. 4, Feb. 20, 1931, p. 678.

The alloy is treated with an alkali metal such as sodium to form a less fusible alloy of antimony and alkali metal which is dissolved in caustic alkali in the molten state; the caustic melt is separated and treated with water to separate antimony in the metallic state.

Illinois Zinc Co. Zinc alloys. French Patent 706412, Oct. 18, 1930. Chem. Abs., vol 26, No. 3, Feb. 10, 1932, p. 690.

Alloys of zinc suitable for laminated bands are made by adding to molten zinc, copper and a metal of the seventh group in amount such that the metals remain in solid solution when solidified. Examples contain zinc 5,450, copper 13.6, and silver 0.24 parts or zinc 1,000, copper 10, and antimony 1 part. The alloys have increased resistance to traction and increased hardness.

Kemp, Paul. Hardened alloy of lead and antimony. U. S. Patent 1807788, June 2, 1931. Chem. Abs., vol. 25, No. 16, Aug. 20, 1931, p. 4216.

A lead-antimony alloy of greater than normal hardness contains a maximum of 10 per cent antimony, about 0.2 per cent arsenic, and about 0.1–2 per cent tin (the tin being present in about one-fifth the quantity of the antimony). The alloy is suitable for tempering, quenching, and seasoning.

Kränzlein, Georg, Müller, Richard K., and Brunntrager, Franz. Accumulators. German Patent 520726, Feb. 6, 1929. (Addition to 517505). Chem. Abs., vol. 25, No. 13, July 10, 1931, p. 3254.

In making the hard lead electrodes of German Patent 517505, a lead-antimony alloy containing about 3 per cent antimony is used.

Masi, Teodosio. Inoxidizable alloy. French Patent 704559, Aug. 14, 1930. Chem. Abs., vol. 25, No. 17, Sept. 10, 1931, p. 4515.

An inoxidizable alloy contains nickel, copper, manganese, and antimony in suitable proportions. Thus, nickel 60, copper 35, manganese 4, and antimony 1 kg are fused together. To 15 kg of this fused alloy 15 kg of nickel are added, and when molten 7 kg of red copper are added. The temperature is lowered, and 10 kg of the first alloy are added followed by 2.2 kg of manganese and 0.8 kg of antimony.

Metallgesellschaft, A.-G. Aluminum alloys. German Patent 531782, Mar. 20, 1924. Chem. Abs., vol. 26, No. 1, Jan. 10, 1932, p. 75.

The mechanical properties of aluminum alloys containing less than 3 per cent copper and 1 per cent silicon are improved by rolling, annealing, and storing at 100°–200°. The alloy is further improved by addition of small quantity of zinc, cadmium, antimony, tin, or other metals of the iron group.

——— Aluminum alloy. French Patent 706721, Nov. 29, 1930. Chem. Abs., vol. 26, No. 1, Jan. 10, 1932, p. 75.

An aluminum alloy resistant to corrosion contains magnesium 0.1–6, silicon 0.6–6, and 0.2–10 per cent of one or more metals of the iron group, that is, manganese, nickel, cobalt, chromium, and titanium. The alloy may also contain up to 10 per cent of antimony, cadmium, or bismuth taken together or singly; and it is improved by reheating to near its solidification point, quickly cooling and aging at normal temperature.

Muturo, Roku. Alloy for rubber molds. Japanese Patent 90325, Feb. 18, 1931. Chem. Abs., vol. 25, No. 16, Aug. 20, 1931, p. 4216.

The alloy, composed of lead 60–80, tin 15–25, bismuth 5–15, and antimony 0.5–2.5 per cent, is acid-proof and melts at about 320°.

Palm, John V. O., and Knuth, Edward C. (to Cleveland Graphite Bronze Co.) Bearing alloy. U. S. Patent 1807670, June 2, 1931. Chem. Abs., vol. 25, No. 16, Aug. 20, 1931, p. 4215.

The alloy consists of lead 82, cadmium 7.5, antimony 7.5, and zinc 3 per cent. Cf. Chem. Abs., vol. 24, p. 1336.

Schmidt, Karl. Aluminum alloys. German Patent 534376, June 8, 1924. Chem. Abs., vol. 28, No. 5, Feb. 10, 1932, p. 689.

Aluminum alloys containing chromium up to 6 and antimony up to 5 per cent are used for the construction of articles required to resist sea water.

——— Aluminum-magnesium alloys. German Patent 528025, Oct. 8, 1925. Chem. Abs., vol. 25, No. 17, Sept. 10, 1931, p. 4517.

Aluminum-magnesium alloys containing up to 10 per cent magnesium are rendered resistant to corrosion by sea water, etc., by causing the crystals rich in magnesium, deposited when the molten alloy is allowed to set, to diffuse uniformly into the crystals poor in magnesium. This may be effected by annealing. The resistance of the alloys is also increased by incorporating antimony up to 10 or cadmium up to 15 per cent.

Seljesaeter, Karre S. (to the Western Electric Co. (Inc.)) Alloy. Canadian Patent 311353, May 12, 1931. Chem. Abs., vol. 25, No. 13, July 10, 1931, p. 3307.

An improved ternary alloy is made by alloying not more than 4 per cent antimony and not more than 1 per cent arsenic with lead, converting the resultant alloy to a supersaturated solid solution and allowing the alloy to assume a more stable state.

Siemens-Schuckertwerke, A.-G. Lead-antimony alloy for pressed tubes, more particularly for cable sheaths. British Patent 362973, Sept. 10, 1930. Chem. and Ind. (London), vol. 51, No. 12, Mar. 18, 1932, p. 231.

Alloys of lead with less than 1 per cent antimony and less than 1 per cent of a compound of antimony with copper, nickel, manganese, or magnesium, or, preferably, cadmium are claimed. For cable sheathing the alloy comprises 99.25 per cent lead, 0.25 per cent antimony, and 0.5 per cent cadmium-antimony.

——— Alloy of lead and antimony. French Patent 702261, Sept. 12, 1930. Chem. Abs., vol. 25, No. 15, Aug. 10, 1931, p. 3953.

An alloy of lead suitable for cable casings contains lead 98 or more and antimony up to 1 per cent; the rest consists of a compound of antimony and cadmium, copper, nickel, manganese, or magnesium.

Siomi, Tutomu, Ono, Kenzo (to Hurukawa Denki Kogyo K. K.) Lead alloy. Japanese Patent 90359, Feb. 19, 1931. Chem. Abs., vol. 25, No. 16, Aug. 20, 1931, p. 4216.

The alloy contains antimony 0.05–3, tin 0.05–5, and bismuth 0.05–5 per cent. It is resistant to corrosion and has satisfactory strength and elongation ratio.

Thielers, Martin. Lead alloy containing antimony and bismuth. French Patent 691603, Mar. 8, 1930.

Vereinigte Stahlwerke, A.-G. Rustless steel. French Patent 695398, May 10, 1930. Chem. Abs., vol. 25, No. 11, June 10, 1931, p. 2680.

A steel or cast iron which does not tend to rust is made by alloying, with the steel or iron, elements whose electrolytic potential is below the constant oxidation potential of the corrosion agent but is above the electrolytic potential of the steel or iron and which by reason of their electrochemical properties provoke, during the corrosion, the formation of an adhering antirusting layer. Antimony, arsenic, bismuth, or tin in amounts of 0.5–5 per cent alone or together and with or without copper may be used.

Vereinigte Telephon- und Telegraphen-Fabriks-A.-G. Czeija, Nissl & Co. Alloys for sheathing electric cables. Austrian Patent 121525, Oct. 15, 1930.

Wemple, Leland E., and Warren, Floyd A. Zinc alloy containing small proportions of copper and antimony. U. S. Patent 1818774, Aug. 11, 1931. Chem. Abs., vol. 25, No. 20, Oct. 20, 1931, p. 5388.

An alloy of greater hardness than zinc and which may be mechanically worked in various ways is composed of zinc 100, copper 0.1–2.25, and antimony 0.01–2.0 parts.

COBALT[1]

By P. M. TYLER and A. V. PETAR[2]

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GENERAL CONDITIONS

A small carload of cobalt-manganese ore was shipped from Rock Run, Cherokee County, Ala., in 1931, the first domestic production of cobalt ore since 1921. Development work was reported to be in progress at deposits in Arizona, California, Colorado, Nevada, and Oregon, although no cobalt production was reported to the Bureau of Mines from these States.

IMPORTS

Cobalt ore, cobalt metal, oxide, and other compounds of cobalt imported for consumption in the United States, 1928–1931

	1928		1929		1930		1931	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Cobalt ore	107,498	$25,922	434,443	$51,862	199,642	$18,994	83,895	$8,453
Cobalt metal	535,817	1,147,574	806,640	1,743,465	460,251	984,244	164,967	254,520
Oxide	364,154	692,753	475,928	884,873	425,881	769,331	321,891	391,479
Linoleate					91	38		
Sulphate	68,150	39,791	60,596	34,893	33,084	17,564	23,147	7,595
Other salts	131	202	4,186	2,655	22,128	6,519	23,170	11,768

Cobalt and cobalt ore imported into the United States, 1929–1931, by countries

[General imports]

Country	1929		1930		1931	
	Pounds	Value	Pounds	Value	Pounds	Value
Australia	209,420	$33,413	49,034	$8,173	23,296	$4,542
Belgium	498,749	1,159,426	368,788	809,156	99,198	159,299
Canada	499,758	533,087	216,181	130,628	118,872	83,172
Germany	33,156	69,401	25,890	55,281	3,016	5,876
United Kingdom					4,480	10,084
	1,241,083	1,795,327	659,893	1,003,238	248,862	262,973

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[1] Work on manuscript completed June, 1932.

[2] Statistics on foreign production compiled by L. M. Jones, of the Bureau of Mines. Figures on imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

PRICES

Cobalt prices declined during 1931. The black oxide (70 to 71 per cent cobalt), which was valued at $2.10 per pound throughout 1930, was quoted at that figure in January, 1931, but dropped to $1.90 in February, $1.75 in March, $1.45 to $1.75 in May, and finally to $1.35 in July, remaining at this level for the rest of the year. Quotations for 97 to 99 per cent rondelles (imported from Belgium) held firm at $2.50. The declared value of the exports of cobalt metal (all to the United States) averaged $1.88 in 1930 but dropped to $1.18 in 1931; a similar drop was recorded in the average values of the exports of black oxide, which declined from $1.89 in 1930 to $1.14 in 1931. During much of the year cobalt ore, 12 to 14 per cent grade, was quoted at 50 cents per pound, f. o. b. cars, Ontario.

London quotations for the black oxide declined from 8s. in the first five months of 1931 to 4s. during the remainder of the year. Gray oxide was quoted at 8s. 10d. until June, when the price dropped, reaching 4s. 9d. in August and holding at that figure for the remainder of the year. After being quoted at 10s. per pound for the first half of the year the metal dropped to 9s. in July and 7s. in August and September; and due to the depreciation of the pound sterling, quotations during October, November, and December were $3.75 per kilo.

WORLD PRODUCTION

The cobalt supply of the world comes principally from the Belgian Congo and from Canada. Production figures for the several producing countries, however, are reported in such indefinite figures that the estimates of total production are not very exact. The following meager data, compiled from official reports, are all that are available.

World production of cobalt, 1929–1931, in metric tons

Country	Cobalt-bearing material	1929		1930		1931	
		Gross weight	Cobalt content	Gross weight	Cobalt content	Gross weight	Cobalt content
Australia:							
New South Wales	Cobaltiferous manganese ore	5	[1]	--------	--------	--------	--------
Queensland	Cobaltite concentrates, etc.	[1]	20	[1]	4	[1]	[1]
Belgian Congo	[1]	[1]	[2] 2 700	[1]	[2] 2 700	[1]	[1]
Canada: Ontario	Cobalt, alloys, and chemicals	[1]	422	[1]	315	[1]	236
China: Yunnan [3]	[1]	250	[1]	250	[1]	250	[1]
India, British: Burma [4]	Cobaltiferous nickel speiss	3, 051	107	3, 102	109	3, 504	123
Union of South Africa	Cobalt ore	3	.5	--------	--------	45	1

[1] Data not available.

[2] Cobalt in metal, oxide, and salts produced at Oolen, Belgium.

[3] Approximate production.

[4] Year ended June 30 of year stated.

Australia.—In Queensland the Success cobalt mine in the Cloncurry district was worked in 1931, chiefly at the 90-foot level; however, the values were far from satisfactory, and according to official reports it is doubtful if the mine will be reopened in 1932.

Canada.—The production of cobalt in Canada in 1931 was 521,051 pounds, compared with 694,163 pounds in 1930 and a high record of 3,066,000 pounds in 1909. Due to decreased demand and a sharp drop in the price paid for cobalt ores during the year the estimated value of the production registered a far greater decline—from $1,144,007 in 1930 to $651,179 in 1931.

All the cobalt produced in Canada comes from the silver-cobalt-arsenic mines at Cobalt, Gowganda, and South Lorrain in northern Ontario. Formerly cobalt was obtained as a by-product from working these mines primarily for silver; recently, however, with depletion of the richer silver-bearing portions of the deposits, the fall in the price of silver, and the increased demand for cobalt, considerable silver-free and low-silver cobalt ore that formerly was left in the mines as unprofitable has been mined by lessees.[3] Part of this cobalt ore is exported as such and part is treated in Canada. The only Canadian company producing cobalt metal, oxides, and salts is the Deloro Smelting & Refining Co. (Ltd.), with works at Deloro, Ontario. The chief producer of cobalt ore in 1931 was the Mining Corporation of Canada, whose output was sold to the Deloro company under a contract made at the beginning of the year at prices considerably higher than those at the close of the year. This contract terminated on December 31, and early in 1932 it had not been renewed. With continued low prices for silver it is reasonable to expect a further decrease in the production of cobalt in 1932. Many properties would have closed in 1931 if they had not been able to dispose of their cobalt at a moderately high price.

The nickel-copper ores of Sudbury, Ontario, carry small amounts of cobalt (about 0.1 per cent), but neither company returns nor Government records show any production from this source.

Germany.—Mining has been resumed at the Phillips Hoffnung cobalt mine in Siegerland, Westphalia.

Morocco.—Reference to a cobalt discovery in Morocco appeared in the Mining Journal (London) of November 7, 1931, page 836.

South Africa.—Development work was carried on at the Kruis River cobalt mine in the Transvaal, by Mineral Holdings (Ltd.), a subsidiary of Transvaal Estates (Ltd.). During two months in the early part of 1931, 50 short tons of development ore, estimated to contain 2 per cent cobalt, were brought to the surface. Cobalt was discovered in the Waaikraal Mine about the middle of 1928, and a small company was floated in the beginning of 1929 to develop and equip the old Kruis River property. Work was not carried on for any great length of time. Cobalt is present as smaltite. The mineral "transvaalite" (an oxidation product of cobalt arsenide), which was originally discovered at Kruis River, is also found. Within a short distance of the Kruis River mine is the Balmoral Mine, where cobalt-bearing lodes run in an easterly and westerly direction.[4]

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[3] Mines Branch, Department of Mines, Ottawa, Canada, The Canadian Mineral Industry in 1931 (Preliminary report): March, 1932, p. 4.

[4] South African Mining and Engineering Journal, Cobalt Occurrences in the Bushveld: Vol. 42, pt. 1, Aug. 8, 1931, p. 623.

MOLYBDENUM[1]

By P. M. TYLER and A. V. PETAR[2]

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DOMESTIC PRODUCTION

The production of molybdenum concentrate in the United States during 1931, although considerably less than in 1930, was slightly greater than the average for the 5-year period 1926 to 1930.

Production at the mines in 1931 amounted to approximately 3,000 short tons of concentrates containing 5,221,000 pounds (average 85.93 per cent) of molybdenum sulphide (MoS_2). In 1930 the production was 3,618 tons of concentrates containing 6,205,000 pounds (average 85.75 per cent) of molybdenum sulphide. Concentrates shipped from mines in 1931 contained an equivalent of 3,157,000 pounds of elemental molybdenum valued, more or less arbitrarily, at $1,577,000, compared with 3,759,269 pounds of molybdenum in 1930, valued at $2,068,000.

In 1931, as in other recent years, the Climax Molybdenum Co. at Climax, Lake County, Colo., and the Molybdenum Corporation of America at Questa, Taos County, N. Mex., were the principal producers. In addition, a small quantity of high-grade concentrates was recovered by J. L. Fulton, who operated the Santo Niño Mine of the Southern Copper Mining Co. at Patagonia, Santa Cruz County, Ariz.

Molybdenum in ore and concentrates, produced in the United States, sold in 1927–1931

Year	Pounds	Value
1927	2,286,075	$1,858,786
1928	3,329,214	1,924,600
1929	3,904,648	[a] 2,259,000
1930	3,759,269	[a] $2,068,000
1931	3,157,000	[a] 1,577,000

[a] Estimate by Bureau of Mines.

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[1] Work on manuscript completed June, 1932.

[2] Statistics on domestic production prepared by H. W. Davis and figures on foreign production compiled by L. M. Jones, both of the Bureau of Mines. Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Colorado.—The Climax Molybdenum Co. alone furnishes fully 75 per cent of the world output and has apparently developed ore reserves sufficient to supply the requirements of the entire world for 190 years, at the present rate of consumption. The ore is low grade, yielding less than 1 ton of concentrates for each 100 tons mined and milled, but recoveries are high—over 90 per cent—and costs per ton are low. The following notes by John W. Vanderwilt,[3] with reference to the history and prospects of the Climax Molybdenum Co., are of interest.

> The Climax Molybdenum Co., the present owner of the deposit (nearly 1 mile east of Climax), began its first active development in 1917 and by February, 1918, was producing ore at the rate of 250 tons per day. Production was suspended in April, 1919, because at the close of the war large stocks of molybdenum existed both in Europe and America while demand and price decreased greatly. The company kept its plant in shape and in addition spent much money in metallurgical research and widespread advertising of the value of molybdenum as a ferro-alloy.
>
> Mining operations were resumed in August, 1925, and planned for a limited yearly output. Demand exceeded expectations, and production was increased from 150 tons daily in 1925 to 1,000 and 1,200 tons in 1928. * * *
>
> The Climax company has been mining and milling 1,000 to 1,500 tons daily during the last three years, producing over 3,000,000 pounds of molybdenum annually. It is equipped to increase production to 6,000,000 pounds annually if necessary. The mill recovers 90 per cent molybdenite concentrate. * * *
>
> The reserve tonnage as calculated by W. J. Coulter, superintendent at Climax for the Climax Molybdenum Co., will yield over 760,000,000 pounds of molybdenum, which is 190 times as much as the entire world's annual production of nearly 4,000,000 pounds in recent years.

New Mexico.—The mine of the Molybdenum Corporation of America is in the Red River mining district, Taos County, in northern New Mexico. The mill and camp are in the valley of Red River about 7 miles east of Questa; the mine is 1¼ miles away in Sulphur Gulch, a tributary of Red River. The mine is about 600 feet higher than the mill at an altitude of about 8,700 feet. The climate is cold in winter but does not interfere seriously with continuous operation. The mine normally produces about 40 tons of molybdenum sulphide per day, which is concentrated at the local mill and shipped to the plant of the Molybdenum Corporation at Washington, Pa., where it is made into either ferromolybdenum or "molyte." The ore is mined from narrow, irregular veins by the cut-and-fill method. About 65 men are normally employed underground and on the surface at the mine. The mill has a capacity of 50 tons of ore per day and utilizes flotation methods. Water is taken from Red River. Power is generated by a water wheel or, in times of water shortage during the winter, by a Diesel engine. The mill is close to the bottom of a canyon to obtain maximum head on the water wheel, and the flow of ore is therefore maintained partly by gravity and partly by an elevator and pumps. Further information on the operations of the Molybdenum Corporation of America appears in two papers by J. B. Carman, manager, recently published by the Bureau of Mines—Information Circular 6514, Mining Methods of the Molybdenum Corporation of America at Questa, N. Mex., and Information Circular 6551, Milling Methods at the Questa Concentrator of the Molybdenum Corporation of America, Questa, N. Mex. Data as to reserves at the mine of the Molybdenum Corporation of America are not published, but it is known that prospecting and development work in recent years have been considered quite successful. The ore is higher grade than that at Climax, Colo., averaging (after hand sorting) 6 per cent molybdenite.

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[3] Vanderwilt, J. W., Geology of the Molybdenite Deposits at Climax, Colo., and of Other Deposits Producing Molybdenite: Am. Inst. Min. and Met. Eng. (preprint), New York Meeting, February, 1932.

Arizona.—Toward the end of 1931 the management of the Santo Niño property was reorganized; henceforth it will be operated by the Southwest Molybdenum Corporation of Nogales. Considerable molybdenite has been shipped from the property in copper ores and not recovered; the molybdenum and copper are now being separated. Further activity in molybdenum was reported elsewhere in Arizona, but details as to actual results are lacking.

California.—In California assessment work only was done in 1931 on the Libby group of molybdenum claims, located during the summer of 1930.

Idaho.—The International Molybdenum Co. was building a wagon road and had installed a compressor at its property at Porthill, Boundary County, expecting to start shipping in 1932.

Washington.—Late in 1931 flotation tests were made on ore from the Omak property of the Molybdenum Mines Co. in Okanogan County. A molybdenum deposit more than 350 feet long was reported to have been encountered in driving a tunnel on the property of the Deer Trail Monitor Mines in western Stevens County.

PRICES

Quotations for calcium molybdate or "molyte," which were reduced in October, 1930, from 95 to 85 cents per pound of molybdenum contained, remained unchanged in 1931. Molybdenum is introduced into steel principally in this form, but the use of ferromolybdenum is said to be on the increase although the price ($1 per pound of contained molybdenum in 1931) is somewhat higher.

IMPORTS AND EXPORTS

In 1931, as in recent years, no molybdenum ore was imported into the United States; from 1922 to 1927 imports were as follows:

'*Molybdenum ore*[1] *(steel-hardening)" imported for consumption in the United States, 1922–1931*[2]

Year	Pounds	Value	Year	Pounds	Value
1922	412,221	$90,015	1925[3]	1,954	$1,793
1923[3]	16,671	13,115	1926[3]	13,397	11,175
1924[3]	10,379	9,038	1927[3]	12,541	10,472

[1] 1922, recorded as molybdenum ore; 1923–1931, recorded as molybdenum content of ore.

[2] No imports reported for 1928 to 1931.

[3] Classification under tariff of Sept. 22, 1922, "Molybdenum ore and concentrates (molybdenum content)."

Figures on exports of molybdenum are not separately recorded by the Bureau of Foreign and Domestic Commerce.

WORLD PRODUCTION

Three companies produce all but 2 or 3 per cent of the world's molybdenum. Two of these—the Climax Molybdenum Co., operating in Colorado, and the Molybdenum Corporation of America, operating in New Mexico—are in the United States, and one—the Knaben Molybdaengruber A/S—operates at Knaben, east of Stavanger, Norway. The accompanying table shows the world production of molybdenum in 1930 and such data as are obtainable for 1931. The table has been compiled from available official reports.

World production of molybdenum ores and concentrates, 1930 and 1931

Country	Mineral	Concentrates	Per cent MoS_2	Contained molybdenum	Value
1930		*Metric tons*		*Metric tons*	
Australia:					
New South Wales	Molybdenite	3	(1)	(1)	$2,115
Queensland	do	2	(1)	(1)	1,935
Austria	Wulfenite	(1)	(1)	0.2	(1)
Chosen	Molybdenite	26	(1)	(1)	14,313
Morocco, French [2]	do	.8	(1)	(1)	785
Norway	do	284	75	128	227,993
United States	do	3,282	85.75	1,688	2,048,000
1931					
Australia:					
New South Wales	Molybdenite	0.3	(1)	(1)	245
Queensland	do	.3	(1)	(1)	218
Austria	Wulfenite	(1)	(1)	(1)	(1)
Chosen	Molybdenite	(1)	(1)	(1)	(1)
Mexico	do	(1)	(1)	4	6,789
Morocco, French [2]	do	5	(1)	(1)	3,136
Norway	do	182	(1)	(1)	(1)
United States	do	2,756	85.93	1,421	1,566,000

[1] Data not available.
[2] Exports.

Australia.—A new find of molybdenite was reported in Australia at Deep Creek, Araluen, New South Wales.

Canada.—No further work has been done on the Molybdenite Reduction Co. property south of Amos, Abitibi County, Quebec, since the Hollinger Consolidated Gold Mines (Ltd.) dropped its option in June, 1930, or at the Alice Arm property (Skeena Mining Division, British Columbia) of the Dalhousie Mining Co. (Ltd.), Victoria, British Columbia, which was closed down early in 1931. A car lot of the ore sent in 1930 to the Mines Branch, Ottawa, for testing, indicated that good concentrates could be made. The Phoenix Molybdenite Corporation (Ltd.) of Toronto prospected its Bagot property in Renfrew County, Ontario. Mining machinery was installed, and 12 tons of partly selected ore running about 5 per cent MoS_2 were shipped in the fall of 1931 to the Mines Branch, Ottawa, for testing. Good results were obtained, indicating an 85 per cent MoS_2 concentrate and a recovery of 94 per cent. About one-half ton of the concentrate was shipped to Montreal and exported.

Norway.—Preliminary reports indicate that the output of molybdenite concentrates from the Knaben mine in Norway dropped to 182 metric tons in 1931, from 284 tons in 1930.

Russia.—The discovery of a small deposit of molybdenum ore was reported in the Khibinsk district of the Kola Peninsula.[4]

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[4] Economic Review of the Soviet Union, Molybdenum Deposits Found in Khibinsk: Vol. 6, 1931, p. 119

USES

As by far the bulk of molybdenum produced is used in steel manufacture, it follows that the drastic curtailment in steel-mill operation affected consumption. However, although the production of molybdenum-treated steels undoubtedly dropped in 1931, the production of such steels continued to increase in comparison with plain carbon and other alloy steels. Molybdenum is used chiefly in combination with other alloys, especially chromium, nickel, and vanadium. These steels are used extensively in the automotive industries, and certain new nickel-molybdenum steels are finding applications in the chemical industry because they can resist hydrochloric as well as sulphuric acid. Nickel-molybdenum alloys with chromium added will also resist nitric acid and wet chlorine, but these alloys can not be forged or rolled into sheets like simple nickel-molybdenum steels. High-molybdenum steels up to 15 per cent have been made and actually rolled commercially, but due to the high cost of the element and a tendency of molybdenum to volatilize such steels have not been widely used; however, molybdenum is an important constituent of many tool and magnet steels, and in the high-speed steels 1 per cent of molybdenum tends to replace 2 to 2½ per cent of tungsten. Most of the commercial nitriding steels contain a little molybdenum, which is added mainly to prevent temper brittleness that might arise from the nitriding operation.[5] Possibly the principal commercial development during 1931 was the rapid increase in the use of molybdenum in cast iron. One of the large motor-car makers is employing a straight molybdenum cast iron in all brake drums, because molybdenum iron does not develop cracks with repeated heatings and coolings. The iron is also being used widely in grate bars, molds, and annealing pots and similar articles where absence of growth is a vital property. Molybdenum sheet is employed in the radio industry, and molybdenum wire is used as a supporting filament in incandescent lamps as well as radio tubes. Molybdenum compounds are of importance in the chemical industry, notably as laboratory reagents and as catalysts.

A new use[6] for molybdenum has been developed in connection with the placing of carbide tips on cutting tools. An insert of pure molybdenum metal is brazed between the steel shank and the tantalum carbide tip. As molybdenum has almost the same coefficient of expansion as the tantalum carbide alloy (trade name, "Ramet") the use of molybdenum inserts prevents strains being set up or cracks developing in the cutting tips as tools cool after the brazing operation. Such strains as may develop between the molybdenum insert and the steel shank are entirely absorbed by the molybdenum, due to its great ductility. Molybdenum inserts are especially desirable in tools where the carbide tips are long, thin, or of unusual shape or where unusually severe conditions of operation are expected. In small tools the tantalum carbide tip is now often mounted on a shank of solid molybdenum.

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[5] Gregg, J. L., and Gillett, H. W., Molybdenum, Today and Tomorrow: Metals and Alloys, vol. 3, No. 4, April, 1932, pp. 98–103.

[6] Metals and Alloys, Molybdenum Cushions Protect Tantalum Carbide Tools: Vol. 2, No. 6, December, 1931, p. 364.

An extensive investigation at Watertown Arsenal[7] of molybdenum high-speed steel containing no tungsten has demonstrated that such steels are equal to the more expensive and generally used tungsten steel for many purposes. A manufacturer of tool steels has recently made a fairly large quantity of the steel developed by the arsenal, and little difficulty was encountered in producing satisfactory shapes. The successful utilization of molybdenum high-speed steels results from the development of a simple method for preventing the formation of a soft skin which was found to result from decarburization rather than from removal of molybdenum. The method consists merely of keeping the surface of the steel covered with a thin coating of borax while it is hot.

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[7] Williams, C. E., and Gregg, J. L., Iron and Steel Metallurgy in 1931: Min. and Met., vol. 13, January 1932, pp. 27–29.

TANTALUM[1]

By P. M. Tyler and A. V. Petar[2]

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GENERAL CONDITIONS

Tantalum may be precisely described as a rare metal. Australia has long been the principal source of ore, and except for somewhat sporadic production in the United States virtually no other commercial sources of the element have yet been disclosed. The world consumption of tantalum ores probably has never exceeded 20 tons in a single year and often is less than 10 tons. In terms of metal content the normal tonnage requirements may be estimated at roughly 1 per cent of the world's annual output of gold.

Little information is available concerning the production of tantalite in Australia within the past two or three years. During 1930, 3 long tons of tantalite, valued at £1,254, were produced in Western Australia, all of which were exported; a like amount was produced in North Australia, presumably from the alluvial workings in the vicinity of the old Mount Finnis tin claims.

Sundry discoveries of tantalite in Canada have been announced in recent years, but apparently no production has materialized. During 1931, however, Robert E. Lowther, of Buffalo, N. Y., and a group of associates acquired title to 10,000 acres in Renfrew County, Ontario, about 70 miles west of Ottawa, with a view to developing deposits of tantalite, columbite, and other rare-metal ores.

A process for the extraction of tantalum and columbium from their ores was described in a paper by Fink and Jenness.[3] By means of this process it would seem to be possible to produce a pure grade of tantalum oxide at a cost of $2 per pound, making no allowance for an equivalent quantity of the combined oxides which could be recovered from the solution at a considerably cheaper cost.

Throughout 1931 tantalum ore was quoted at 70 cents per pound of Ta_2O_5 contained, and C. P. tantalum bar and heavy sheet were quoted at $91 per kilo.

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[1] Work on manuscript completed June, 1932.

[2] Statistics on domestic production prepared by H. W. Davis, of the Bureau of Mines. Figures on imports compiled by J. A. Dorsey, also of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

[3] Fink, C. G., and Jenness, L. G., Extraction of Tantalum and Columbium From Their Ores: Am. Inst. Min. and Met. Eng. Tech. Pub. No. 379, 1931, 18 pp.

DOMESTIC PRODUCTION

Domestic production in 1931 was sharply reduced by the almost complete lack of demand. A few hundred pounds of columbite were shipped by Philip S. Hoyt from Las Tablas, N. Mex., and a smaller quantity was shipped by Dr. A. T. Roos from the Black Hills (near Rapid City) of South Dakota. At Spruce Pine, N. C., the Consolidated Feldspar Corporation sorted out, but did not sell, 200 or 300 pounds of columbite in 1931.

The following table shows the production of tantalum minerals in the United States during the past five years.

Columbite, mined in the United States, shipped in 1927–1931

Year	Pounds	Value	Year	Pounds	Value
1927	1,100	$378	1930	5,100	$3,350
1928	34,899	26,332	1931	700	490
1929	22,117	17,261			

IMPORTS

The bulk of the domestic supply of tantalum has been imported as ore. The following table shows imports for consumption since 1927.

Tantalum ores imported into the United States, 1927–1931 [1]

Year	Pounds	Value	Year	Pounds	Value
1927	[2] 15,119	$20,012	1930	[2] 8,474	$7,036
1929	[2] 15,250	19,418	1931	[3] 6,288	6,289

[1] No imports reported for 1928.
[2] Classified as "Ores of ferro-alloying metals (tantalum)."
[3] Classified as "Tantalum and columbium ores."

TITANIUM[1]

By P. M. TYLER and A. V. PETAR[2]

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GENERAL CONDITIONS

In 1931 noteworthy changes took place in the organization of the titanium pigment industry in the United States. Titanium pigments are manufactured chiefly by two firms—the Titanium Pigment Co. (a subsidiary of the National Lead Co.) and the Krebs Pigment & Color Corporation (formerly the Commercial Pigments Corporation).

The Titanium Pigment Co. was the first company in the United States to undertake the manufacture of titanium pigments and prior to 1931 operated plants at Niagara Falls, N. Y., and St. Louis, Mo. In 1931, however, the company transferred all of its pigment business to St. Louis; and it was understood that later a new plant would be built at tidewater, probably in the vicinity of New York. The Titanium Pigment Co. manufactures titanium dioxide, Titanox B, and Titanox C pigments.

The titanium pigment business of the Commercial Pigments Corporation, a subsidiary of the Commercial Solvents Corporation, was consolidated with the lithopone and dry color business of the Krebs Pigment & Chemical Co. and the pigment and dry color division of the Grasselli Chemical Co. during 1931, as a result of the formation of a new company known as the Krebs Pigment & Color Corporation, of Newark, N. J. The company manufactures titanium dioxide and titanated lithopones (Ti Tone and Duolith). The titanium dioxide product is marketed by the company sales agent (R. T. Vanderbilt Co., New York City) under the trade name "Rayox."

Another titanium lithopone (Titanolith) is manufactured by the Chemical & Pigment Co., San Francisco, Calif.

Although the market for most white pigments was affected adversely by the general business depression, sales of titanium pigments apparently continued to increase during 1931, and prices remained stationary throughout the year. In January, 1932, however, a reduction of one-half cent a pound was made in the price of calcium-base titanium pigments.

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[1] Work on manuscript completed June, 1932.

[2] Statistics on domestic production prepared by H. W. Davis and figures on foreign production compiled by L. M. Jones, both of the Bureau of Mines. Figures on imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

DOMESTIC PRODUCTION

During 1931 the American Rutile Co. (a subsidiary of the Metal & Thermit Corporation) shipped ilmenite and rutile from its properties at Roseland, Nelson County, Va. The mill was operated steadily until cold weather. Particular attention was given to improving the recovery of fine material through better classification and the installation of a thickener for the classifier overflow. Development work in two tunnels has substantially enhanced the already large volume of proved ore reserves. The new plant of the Southern Mineral Products Corporation (described in the 1930 chapter of this series) at Piney River, Va., was operated throughout much of the year but not on a commercial basis.

The Titanium Corporation of America was incorporated in October, 1931, to develop rutile properties in Hot Spring County, Ark.

The output of titanium minerals during the past 10 years, so far as data are available to the Bureau of Mines for publication, is shown in the following table, which, however, gives shipments rather than production.

Titanium minerals produced in the United States, 1922–1931 [1]

Year	Rutile concentrates			Ilmenite concentrates		
	Short tons	Percentage of TiO_2	Value	Short tons	Percentage of TiO_2	Value
1922	310	95	(2)	5,181	52–54	(2)
1923	270	95	(2)	6,270	52	(2)
1924	----------	----------	----------	4,769	52	[3] $76,300
1925	46	95	[3] $11,000	5,566	52	[3] 89,000
1926 [4]	30	95	[3] 7,500	4,813	52	[3] 77,000
1927	524	95	129,861	3,500	50	44,000
1928	176	93–96	[3] 37,700	918	50	[3] 21,000

[1] Both rutile and ilmenite concentrates produced in 1929, 1930, and 1931, but Bureau of Mines not at liberty to publish figures.

[2] Bureau of Mines not at liberty to publish figures.

[3] Arbitrary value.

[4] Figures for Florida only. Bureau of Mines not at liberty to publish figures for Virginia.

IMPORTS

The bulk of the ilmenite consumed in the United States is imported. In 1931 the imports registered a substantial increase, amounting to 29,857 long (33,440 short) tons, valued at $144,951, compared with only 22,297 long (24,973 short) tons, valued at $150,466, in 1930 and 22,386 long (25,072 short) tons, valued at $104,887, in 1929. It will be noted that the average declared value of the imports was $4.85 per long ton in 1931. Ocean freight from India is usually around $5 a long ton, and the trade journal quotations f. o. b. Atlantic seaboard are $10 to $12 a long ton. In 1931 all the shipments were credited to British India, whereas in former years substantial amounts have likewise been received from Senegal and occasionally from Brazil. According to Canadian official reports (see p. 86), however, 1,509 short tons of ilmenite were shipped to the United States in 1931 from the Baie St. Paul district, Quebec.

Imports of rutile in 1931 were reported as 2,000 pounds, valued at $189.

PRICES

During the past decade prices of titanium pigments have dropped steadily. The price of titanium dioxide has been reduced from 35 to 21 cents per pound in less than 5 years. Titanium pigments, formerly quoted at 13 to 13½ cents per pound, are now quoted at 6½ cents per pound (for the barium-base pigment, in carload lots) and 7½ cents (for the calcium-base pigment, in less than carload lots). Early in 1932 a further cut of one-half cent was made in the price of titanium-calcium pigment. At the end of 1931 the price of ferrotitanium was reduced from $150 per short ton (in carloads) to $137.50 for 15 to 18 per cent titanium and 6 to 8 per cent carbon.

Ilmenite containing 45 to 52 per cent TiO_2 was quoted throughout 1931 by the Engineering and Mining Journal at $10 to $12 per long ton, f. o. b. Atlantic seaboard, according to grade and impurities. Low-grade domestic ilmenite, 32 to 35 per cent TiO_2, was nominally $7 to $8 a ton. The quotation for rutile, guaranteed minimum 94 per cent concentrate, remained unchanged at 10 cents per pound.

WORLD PRODUCTION

The world production of titanium minerals in 1930 and 1931, as gathered from Government reports and other available sources, is shown in the following table.

World production of titanium minerals, 1930 and 1931

Mineral and country	1930			1931		
	Ore produced	Content of TiO_2	Value [1]	Ore produced	Content of TiO_2	Value [1]
Ilmenite:	*Metric tons*	*Per cent*		*Metric tons*	*Per cent*	
Brazil [2]	80	53	$1,370	(3)	(3)	(3)
Canada (Quebec)	374	18–25	1,237	1,369	18–25	$9,884
India (Travancore)	29,238	54	160,416	(3)	(3)	(3)
Norway	7,630	43	63,400	(3)	(3)	(3)
Portugal	834	50	3,746	152	50	(3)
Senegal [2]	5,322	48	7,377	(3)	(3)	(3)
United States	(4)	(4)	(4)	(4)	(4)	(4)
Rutile:						
Norway [5]	46	90–93	13,400	(3)	(3)	(3)
United States	(4)	(4)	(4)	(4)	(4)	(4)

[1] Values as officially reported, converted to United States currency at the annual average rate of exchange as published by the Federal Reserve Board.

[2] Exports.

[3] Data not available.

[4] Bureau of Mines not at liberty to publish figures.

[5] Concentrates.

THE INDUSTRY IN FOREIGN COUNTRIES

Australia.—The Radium & Rare Earths Treatment Co., N. L., which was formed a few years ago to exploit and manufacture titanium white from rutile found on its property at Olary, South Australia, decided to abandon the project as production costs were excessive and it was more economical to import ilmenite from Africa and India.[3] The Titanium Products Pty. (Ltd.) was established in Melbourne to manufacture titanium oxide pigments but did not enter into production during 1931. It is reported that the company intends to purchase ilmenite from King Island, a small island off the coast of Tasmania.[4]

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[3] Peabody, S. R., Australian Firm Discontinues Plan to Manufacture Titanium White: U. S. Bur. For. and Dom. Com., World Trade Notes on Chemicals, etc., vol. 5, No. 28, 1931, p. 5.

Canada.—Ilmenite carrying 18 to 25 per cent titanium occurs in large bodies at Ivry, Terrebonne County, and at St. Urbain, Charlevoix County, Quebec, and occasionally small quantities are mined and shipped from these places for export to the United States. Small shipments have also been made to England for experimental purposes. During 1931, 1,509 short tons of ilmenite, valued at $10,261, were shipped from the Baie St. Paul district, Quebec, to the United States. Canada has no titanium industry, but a Canadian company—Titanium (Ltd.)—has obtained control of the Ivry ilmenite deposits to utilize material from them in the manufacture of titanium white. So far no plant has been erected in Canada.[5]

Czechoslovakia.—Although there was a lower total production of pigments, especially lithopone and zinc white, due to decreased building activities, and a marked decrease in consumption during 1930, sales of titanium white increased considerably.[6]

France.—The Thann works of Alsace produce about 600 tons of pure titanium white yearly by the Blumenfeld process. Ilmenite is attacked by sulphuric acid, iron sulphate is separated, and the subsequent titanium sulphate is hydrolized. The Société Française du Titane uses the Carteret-Devaux process, which is based on the preparation of titanium tetrachloride (by the action of chlorine on coal and titanium ore) and hydrolization of the titanium tetrachloride yielded after separation from ferric chloride. The Société Française du Titane sells composite titanium white (a mixture of titanium dioxide and sulphate of barium). Imports of this mineral color increased from 300 tons in 1928 to 750 tons in 1929. These figures include both the concentrated product and products mixed with sulphate of barium or other mixtures.[7]

French Africa.—Crystals of rutile resulting from the disintegration of certain gneisses are found at Djougou in Dahomey, French West Africa, and at Blidouba on the Ivory Coast, and important deposits of rutile are said to be present in the region of Gao in the Sudan. However, the only titanium deposits in French West Africa that are exploited are ilmenite. Detrital deposits are found along the coast of Senegal between Rufisque and the mouth of the Gambia River. The principal centers of exploitation are in the vicinity of Joal. Sands resulting from the disintegration of the basaltic rocks of Cape Verde extend along the coast in more or less continuous deposits usually 50 cm in thickness. Exploitation is very easy, and simple washing suffices to separate the ilmenite from zircon, garnet, magnetite, and other associated minerals. The titanium content of the ilmenite sands of the coast of Senegal is about 50 per cent. Similar deposits are known farther north in Senegal, in the vicinity of St. Louis. Titaniferous sands have also been noted on the Ivory Coast at Grand Lahou, between the mouths of the Cavally and Bandama Rivers. In addition to the ilmenite titanium is also found on the Ivory Coast in the form of titaniferous magnetite resulting from disintegration of the gneiss in the vicinity of Tabou. These black sands, notably those of Boké near Cavally, contain about 10 per cent TiO_2.[8]

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[4] Bureau of Foreign and Domestic Commerce, Melbourne Firm Not Ready to Produce Titanium Oxide: World Trade Notes on Chemicals, etc., vol. 6, No. 7, Feb. 15, 1932, p. 5.

[5] Mines Branch, Department of Mines, Ottawa, Canada, The Canadian Mineral Industry in 1931: P. 16.

[6] Woods, S. F., The Czechoslovak Chemical Industry during 1930: Commerce Repts., No. 37, Sept. 14, 1931, p. 668.

[7] Chemical and Metallurgical Engineering, Zinc and Titanium Pigments Make Progress in France: Vol. 38, No. 7, July, 1931, p. 425.

Norway.—The value of the former sizable production of titanium white by Titan A/S of Fredrikstad—4,500,000 crowns in 1928—fell to around 1,900,000 crowns in 1929, with further decreases thereafter. Titan A/S assigned its production of solid titanium oxide to the German I. G., which organized its Titan G. m. b. H. at Leverkusen to manufacture and sell reserved European territory. Norwegian titanium ore is now exported to Germany primarily for processing. In 1929, 6,366 metric tons were exported there, compared with 2,663 tons in 1928 and 215 tons in 1927, when Titan A/S was manufacturing its own oxide.[9]

Russia.—What is claimed to be a large deposit of titanium ores was discovered by a mineralogical research party of the Soviet Academy of Sciences about 6 km from the principal apatite mine at Khibinsk on the Arctic Kola Peninsula in the northwestern part of the Union of Socialist Soviet Republics. Deposits of titanium-iron ore have also been found near Gatzkavo in the Volodarsky district of the Ukraine.[10] It is reported that a titaniferous sand containing about 25 per cent titanium has been discovered in the district of Mariupol, in the Ukraine.[11] Early in 1932 it was also reported that the construction of a large varnish and paint plant would be undertaken at Cheliabinsk in the Urals and that the plant would have an output of 12,000 metric tons of titanium dioxide, as well as powdered and enamel paints, oil varnishes, and driers.[12]

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[8] de la Rue, E. A., Les gisements miniers et minéraux de l'Afrique Occidentale française: Mines Carrières, vol. 11, No. 114, April, 1932, pp. 7–8.

[9] Commerce Reports, Production of Chemical Products in Norway: No. 33, Aug. 17, 1931, pp. 404–406.

[10] Economic Review of the Soviet Union, New Titanium and Rinkolite Deposits: Vol. 6, Sept. 15, 1931, p. 432.

[11] Bureau of Foreign and Domestic Commerce, Deposits of Titanium Ore Discovered in Soviet Russia: World Trade Notes on Chemicals, etc., vol. 6, No. 6, Feb. 8, 1932, p. 8.

[12] Economic Review of the Soviet Union, vol. 7, Apr. 1, 1932, p. 167.

PLATINUM AND ALLIED METALS[1]

By H. W. Davis[2]

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CRUDE PLATINUM

Mine returns for 1931 indicate a production of 506 troy ounces of crude platinum in Alaska, 354 ounces in California, and 25 ounces in Oregon—a total of 885 ounces for the United States. In 1930 Alaska produced 385 ounces, California 129 ounces, and Oregon 13 ounces—a total of 527 ounces.

Platinum refiners in the United States report purchases of domestic platinum in 1931, as follows: Alaska 67 ounces, California 353 ounces, and Oregon 26 ounces—a total of 446 ounces (351 ounces less than refiners purchased in 1930). Refiners in the United States also report purchases of 34,933 ounces of foreign crude platinum in 1931—22 ounces from Canada, 29,611 ounces from Colombia, 1 ounce from Russia, and 5,299 ounces from South Africa. The total is 9,832 ounces less than the purchases reported in 1930. According to the Bureau of Foreign and Domestic Commerce, the imports of crude platinum from Colombia during 1931 were 40,398 ounces, a decrease of 6 per cent compared with 1930; and the total imports of unmanufactured platinum in 1931 were 91,728 ounces, a decrease of 14 per cent.

REFINED PLATINUM METALS

NEW METALS

Reports of refiners of crude platinum, gold bullion, and copper indicate that 36,205 ounces of platinum metals were recovered in the United States from these sources in 1931, a decrease of 17 per cent compared with 1930. It is estimated that 8,393 ounces of the total in 1931 were derived from domestic sources.

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[1] Work on manuscript completed July, 1932.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

New platinum metals recovered by refiners in the United States, 1927–1931, in troy ounces

Year	Platinum	Palladium	Iridium	Osmiridium	Others	Total
1927	41, 121	3, 879	256	631	163	46, 050
1928	51, 427	5, 148	1, 658	458	348	59, 039
1929	41, 760	5, 295	302	364	256	47, 977
1930	37, 780	3, 801	1, 468	334	119	43, 502
1931	31, 274	2, 742	1, 732	272	185	36, 205

New platinum metals recovered by refiners in the United States, 1930 and 1931, by sources, in troy ounces

	Platinum	Palladium	Iridium	Osmiridium	Others	Total
1930						
Domestic:						
Crude platinum	524	6	104	57	26	717
Gold and copper refining	4, 824	3, 650	24	----------	93	8, 591
	5, 348	3, 656	128	57	119	9, 308
Foreign: Crude platinum	32, 432	145	1, 340	277	----------	34, 194
Total recovery	37, 780	3, 801	1, 468	334	119	43, 502
1931						
Domestic:						
Crude platinum	198	2	29	35	3	267
Gold and copper refining	5, 397	2, 595	49	----------	85	8, 126
	5, 595	2, 597	78	35	88	8, 393
Foreign:						
Crude platinum	25, 671	145	1, 654	237	6	27, 713
Ore	8	----------	----------	----------	91	99
	25, 679	145	1, 654	237	97	27, 812
Total recovery	31, 274	2, 742	1, 732	272	185	36, 205

The figures for 1931 in the preceding tables include the new platinum metals recovered by the following concerns in the United States.

American Platinum Works, Newark, N. J.
American Smelting & Refining Co., New York, N. Y.
Baker & Co. (Inc.), Newark, N. J.
Goldsmith Bros. Smelting & Refining Co., Chicago, Ill.
Kastenhuber & Lehrfeld, New York, N. Y.
Pacific Platinum Works (Inc.), Los Angeles, Calif.
Raritan Copper Works, Perth Amboy, N. J.
United States Assay Office, New York, N. Y.
United States Metals Refining Co., Carteret, N. J.
United States Mint, San Francisco, Calif.
United States Mint, Denver, Colo.
Wildberg Bros. Smelting & Refining Co., San Francisco, Calif.

SECONDARY METALS

Secondary platinum metals are those recovered from the treatment of scrap metal, sweeps, and other waste products of manufacture that contain platinum.

Secondary platinum metals recovered in the United States, 1927–1931, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1927	46, 127	4, 244	1, 810	891	53, 072
1928	47, 157	4, 156	2, 090	2, 428	55, 831
1929	33, 638	5, 120	2, 057	1, 944	42, 759
1930	33, 787	7, 426	4, 354	1, 749	47, 316
1931	33, 837	6, 331	1, 823	1, 743	43, 734

The figures for 1931 in the foregoing table include the secondary platinum metals recovered by the following concerns in the United States.

American Platinum Works, Newark, N. J.
Baker & Co. (Inc.), Newark, N. J.
J. Bishop & Co. Platinum Works, Malvern, Pa.
Cincinnati Gold & Silver Refining Co., Cincinnati, Ohio.
Clinton Refining Co. (Inc.), Newark, N. J.
Thomas J. Dee & Co., Chicago, Ill.
Dentists' Supply Co. of New York, York, Pa.
Goldsmith Bros. Smelting & Refining Co., Chicago, Ill.
S. B. Gracier & Sons, San Francisco, Calif.
T. B. Hagstoz & Son, Philadelphia, Pa.
Handy & Harman, New York, N. Y.
Hoover & Strong (Inc.), Buffalo, N. Y.
Irvington Smelting & Refining Works, Irvington, N. J.
Kastenhuber & Lehrfeld, New York, N. Y.
Michigan Refining Works, Pontiac, Mich.
J. M. Ney Co., Hartford, Conn.
Pacific Platinum Works (Inc.), Los Angeles, Calif.
Schwitter, Clover & Starkweather (Inc.), Newark, N. J.
Spyco Smelting & Refining Co., Minneapolis, Minn.
Standard Platinum Co., New York, N. Y.
Tiffany & Co., New York, N. Y.
United States Metals Refining Co., Carteret, N. J.
United States Mint, San Francisco, Calif.
Western Electric Co., Chicago, Ill., and Kearny, N. J.
S. S. White Dental Manufacturing Co., Prince Bay, N. Y.
Wildberg Bros. Smelting & Refining Co., San Francisco, Calif.
Williams Gold Refining Co. (Inc.), Buffalo, N. Y.
H. A. Wilson Co., Newark, N. J.

IMPORTS AND EXPORTS

Platinum metals imported for consumption in the United States, 1927–1931

Year	Troy ounces	Value	Year	Troy ounces	Value
1927	148,769	$12,413,494	1930	139,246	$5,836,492
1928	135,233	9,357,737	1931	129,632	3,531,071
1929	155,075	9,119,479			

Platinum metals imported for consumption in the United States, 1930 and 1931, by metals

Metal	1930		1931	
	Troy ounces	Value	Troy ounces	Value
Platinum:				
Ores of platinum metals (platinum content)			1,097	$27,466
Grains, nuggets, sponge, or scrap	81,229	$3,363,858	67,078	1,905,062
Ingots, bars, sheets or plates, not less than ⅛-inch thick	24,926	961,334	23,553	657,413
	106,155	4,325,192	91,728	2,589,941
Manufactures of, not jewelry	25	520		
Iridium	4,196	665,475	1,773	195,961
Osmiridium	5,654	319,292	4,877	225,485
Osmium	1,100	65,642	960	49,474
Palladium	18,506	353,772	28,070	389,880
Rhodium	2,291	69,717	1,629	61,402
Ruthenium	1,319	36,882	595	18,928
	139,246	5,836,492	129,632	3,531,071

Platinum metals (unmanufactured) imported into the United States in 1931, by countries, in troy ounces

[General imports]

Country	Platinum			Iridium	Osmium and osmiridium	Palladium	Rhodium and ruthenium	Total
	Ores of platinum metals (platinum content)	Grains, nuggets, sponge, or scrap	Ingots, bars, sheets or plates, not less than ⅛ inch thick					
Canada		138			4			142
Colombia	340	40, 058	1, 065					41, 463
France						50	124	174
Germany			258	943			208	1, 409
Peru	12							12
Soviet Russia in Europe		1, 412	5, 386	540				7, 338
United Kingdom	745	25, 470	16, 844	290	5, 833	28, 020	1, 892	79, 094
	1, 097	67, 078	23, 553	1, 773	5, 837	28, 070	2, 224	129, 632

Platinum exported from the United States, 1927–1931

Year	Unmanufactured		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value
1927	19, 923	$1, 577, 560	1, 549	$128, 875
1928	9, 050	619, 478	2, 168	160, 554
1929	2, 567	193, 122	1, 455	112, 252
1930	1, 037	62, 072	769	40, 850
1931	1, 209	40, 769	1, 190	48, 464

Platinum exported from the United States in 1931, by countries

Country	Unmanufactured (ingots, sheets, wire, alloys, and scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value
Bolivia	3	$47		
Brazil	140	5, 397	119	$5, 665
Canada	220	9, 662	179	7, 462
Chile	3	115	12	634
Colombia			3	78
Dominican Republic			22	273
France	491	12, 275	4	201
Germany	61	4, 251		
Italy	26	550		
Japan			136	4, 947
Mexico	4	119	11	500
Philippine Islands			2	57
Union of South Africa			461	14, 716
United Kingdom	261	8, 353	234	13, 565
Venezuela			7	366
	1, 209	40, 769	1, 190	48, 464

SALES BY REFINERS, BY CONSUMING INDUSTRIES

The following table shows the sales of platinum metals to consumers by refiners in the United States in 1930 and 1931. The figures include the sales by refiners in the United States of platinum metals recovered from crude platinum, from gold bullion, from copper and nickel bullion and matte, from electrolytic muds, and from scrap materials and sweeps; in addition they include the sales of considerable quantities of imported platinum metals which are handled by refiners in the United States.

The uses of platinum and its allied metals are many and varied. The most widely used metal of the group is platinum, which constituted 76,990 ounces (nearly 65 per cent) of the total platinum metals sold by domestic refiners in 1931. As the following table shows, the principal consumer of platinum was the jewelry industry. Second in magnitude as a consumer of platinum in 1931 was the chemical industry, where the metal is used chiefly for catalyzers in the manufacture of sulphuric, acetic, and nitric acids, for stills for sulphuric acid, for anodes for electrochemical processes, and as chemical ware in the form of crucibles, dishes, and other laboratory equipment. Third as a consumer ranked the dental industry, where platinum is used chiefly in posts and pins for artificial teeth. The electrical industry was the fourth largest consumer, the metal being used chiefly in contact points, in telephone and telegraph apparatus, and in magneto contacts.

Next to platinum, palladium is the most extensively used of the metals of the platinum group; it constituted 37,923 ounces (nearly 32 per cent) of the total platinum metals sold by domestic refiners in 1931. It is by far the cheapest metal of the platinum group, especially volume for volume, and tends more and more to replace other metals. The largest consumer of palladium in 1931 was the electrical industry, which purchased 22,628 ounces from domestic refiners, compared with 9,569 ounces in 1930. The next largest quantity of palladium is used in the dental industry, where the metal is alloyed with gold and platinum for use in artificial teeth. Much smaller quantities of palladium are used in jewelry and still smaller quantities in chemical ware.

The uses of iridium are few compared with those of platinum and palladium, but it ranks third among the platinum group as regards total consumption; in 1931 sales of iridium amounted to 3,259 ounces (2.7 per cent) of the total sales of platinum metals. It is employed chiefly as a hardener for platinum, principally in jewelry which uses a 10 per cent iridium alloy and in the electrical industry where an alloy containing 15 per cent or more is used.

The consumption of the other platinum metals—osmium, rhodium, and ruthenium—is quite small, amounting to only 0.86 per cent of the total for the group in 1931.

Platinum metals sold by refiners in the United States, 1930 and 1931, by consuming industries, in troy ounces

Industry	Platinum	Palladium	Iridium	Others	Total	Percentage of total
1930						
Chemical	15, 022	854	34	49	15, 959	13
Electrical	8, 529	9, 569	864	70	19, 032	16
Dental	11, 810	15, 436	111	6	27, 363	23
Jewelry	44, 801	2, 807	2, 407	526	50, 541	43
Miscellaneous	3, 324	1, 621	208	876	6, 029	5
	83, 486	30, 287	3, 624	1, 527	118, 924	100
1931						
Chemical	11, 483	979	18	64	12, 544	11
Electrical	8, 215	22, 628	609	17	31, 469	26
Dental	10, 135	9, 394	74	13	19, 616	17
Jewelry	41, 261	2, 988	2, 185	264	46, 698	39
Miscellaneous	5, 896	1, 934	373	667	8, 870	7
	76, 990	37, 923	3, 259	1, 025	119, 197	100

The concerns whose sales to consumers in 1931 are included in the preceding table follow.

American Platinum Works, Newark, N. J.
Baker & Co. (Inc.), Newark, N. J.
J. Bishop & Co. Platinum Works, Malvern, Pa.
Cincinnati Gold & Silver Refining Co., Cincinnati, Ohio.
Clinton Refining Co. (Inc.), Newark, N. J.
Sigmund Cohn, New York, N. Y.
Thomas J. Dee & Co., Chicago, Ill.
Dentists' Supply Co. of New York, York, Pa.
Goldsmith Bros. Smelting & Refining Co., Chicago, Ill.
S. B. Gracier & Sons, San Francisco, Calif.
T. B. Hagstoz & Son, Philadelphia, Pa.
Handy & Harman, New York, N. Y.
Hoover & Strong (Inc.), Buffalo, N. Y.
Kastenhuber & Lehrfeld, New York, N. Y.
Metz Platinum Refining Co., Newark, N. J.
Michigan Refining Works, Pontiac, Mich.
J. M. Ney Co., Hartford, Conn.
Pacific Platinum Works (Inc.), Los Angeles, Calif.
Schwitter, Clover & Starkweather (Inc.), Newark, N. J.
Spyco Smelting & Refining Co., Minneapolis, Minn.
Standard Platinum Co., New York, N. Y.
Tiffany & Co., New York, N. Y.
L. E. Waterman & Co., New York, N. Y.
Western Electric Co., Chicago, Ill., and Kearny, N. J.
Western Gold & Platinum Works, San Francisco, Calif.
S. S. White Dental Manufacturing Co., Prince Bay, N. Y.
Wildberg Bros. Smelting & Refining Co., San Francisco, Calif.
Williams Gold Refining Co. (Inc.), Buffalo, N. Y.
H. A. Wilson Co., Newark, N. J.

STOCKS

Stocks of platinum metals in the hands of refiners on December 31 1931, amounted to 88,485 ounces, virtually the same as at the beginning of the year.

Stocks of platinum metals in the hands of refiners in the United States, December 31, 1927–1931, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1927	68, 757	24, 313	4, 617	4, 369	102, 056
1928	45, 710	23, 018	4, 523	5, 019	78, 270
1929	51, 853	20, 154	4, 716	5, 461	82, 184
1930	52, 853	18, 978	8, 828	8, 006	88, 665
1931	51, 231	17, 553	10, 193	9, 508	88, 485

MARKET AND PRICES

CRUDE PLATINUM

Sellers of domestic crude platinum reported that they were paid for metal content based on assay. Buyers reported purchases at $24 to $60 an ounce for domestic and $19 to $44 an ounce for foreign crude platinum. Buyers of foreign and domestic crude platinum in the United States who reported purchases in 1931 follow.

American Platinum Works, 225 New Jersey Railroad Avenue, Newark, N. J.
Baker & Co. (Inc.), 54 Austin Street, Newark, N. J.
J. Bishop & Co. Platinum Works, Malvern, Pa.
Thomas J. Dee & Co., 1010 Mallers Building, Chicago, Ill.
Goldsmith Bros. Smelting & Refining Co., 1300 West Fifty-ninth Street, Chicago, Ill.
S. B. Gracier & Sons, 212 Stockton Street, San Francisco, Calif.
Kastenhuber & Lehrfeld, 24 John Street, New York, N. Y.
Pacific Platinum Works (Inc.), 814 South Spring Street, Los Angeles, Calif.
Schwitter, Clover & Starkweather (Inc.), 481 Raymond Avenue, Newark, N. J.
Western Gold & Platinum Works, 589 Bryant Street, San Francisco, Calif.
Wildberg Bros. Smelting & Refining Co., 742 Market Street, San Francisco, Calif.
H. A. Wilson Co., 97 Chestnut Street, Newark, N. J.

REFINED METALS

Quotations [3] based on official prices for refined platinum were $36 an ounce from January 1 to February 2; there were several reductions to April 30, when the price dropped to $23 an ounce. On May 18 an increase to $27.50 an ounce was announced, followed by an increase on June 8 to $40, the price for the remainder of 1931. The average of these quotations was $35.67 an ounce. Refiners reported the high price of platinum at $45, the low at $16.50, and the average for the year at $32 an ounce.

Iridium, 98 and 99 per cent sponge and powder, was quoted at $180 to $200 an ounce on January 1, but by the middle of May several reductions had brought the price down to $105 an ounce. On October 8 the price was further decreased to $90 to $100 an ounce; on October 15 the price was increased to $100 to $105; but on November 12 the price was again dropped to $90 to $100 an ounce, the price at the close of the year. Refiners gave the following prices: High, $190; low, $75; and average for the year, $114 an ounce.

Quotations on palladium at the beginning of 1931 were $20 to $22 an ounce but were reduced on February 5 to $19 to $21 an ounce; this price was maintained the remainder of the year. Refiners reported a high of $24, a low of $14, and an average price for the year of $18 an ounce.

The quoted price of rhodium during 1931 fluctuated between $45 and $55 an ounce, that of osmium between $60 and $70 an ounce, and that of ruthenium between $38 and $65 an ounce.

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[3] Metal and Mineral Markets, vol. 2, 1931.

PLATINUM ACCORD

A world platinum accord, which resulted in the formation of Consolidated Platinums (Ltd.),[4] was announced the latter part of October, 1931. The purpose was as follows:

> To buy, sell, import, insure, handle, store, dispose of and/or deal in metals of the platinum group, and compounds and residues thereof; to promote cooperation between members; etc.

According to the Engineering and Mining Journal[5] the Consolidated Platinums (Ltd.) has the following functions.

> * * * Contracts to buy and resell virtually all the new platinum production originating in U. S. S. R., Canada, South Africa, and Colombia, constituting the major portion of the world's output of this precious metal. * * *
>
> The company concluded its contracts after six months of negotiations in London among the principal producers in U. S. S. R., Canada, South Africa, and Colombia, including Edelmetalle-Vertriebs Aktiengesellschaft, Mond Nickel Co. (Ltd.), Johannesburg Consolidated Investment Co., New Consolidated Gold Fields, and Compañia Minera Choco Pacifico. * * *
>
> Sales of platinum which the newly formed company will buy will be through existing distributors and dealers; thus, there will be no change in present distribution methods. * * *

WORLD PRODUCTION

World production of crude platinum from placers, 1927–1931, in troy ounces

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1927	1928	1929	1930	1931
Australasia:					
New South Wales	226	354	128	155	283
New Zealand	33	35	7	3	1
Papua (osmiridium)[1]	60	215	[2] 29	29	47
Tasmania (osmiridium)	633	1,627	1,360	953	1,280
Canada	11	49	28	17	20
Colombia [3]	45,830	53,531	45,577	42,382	44,311
Ethiopia	2,251	3,247	7,716	8,038	6,430
Japan	47	100	147	128	(4)
Madagascar	------	2	------	------	------
Philippine Islands	31	------	------	------	(4)
Russia	[5] 100,000	[6] 78,925	[7] 99,667	[8] 100,000	[8] 100,000
Sierra Leone	------	------	26	546	594
United States	153	528	797	527	885

[1] Year ended June 30 of year stated.
[2] Exports.
[3] Exports, as reliably reported to the author.
[4] Data not available.
[5] Estimated production, Imp. Inst., London; includes recoveries from imported concentrates.
[6] Exports; year ended Sept. 30.
[7] Year ended Sept. 30.
[8] Approximate production.

The following table gives data by which the figures showing the production of crude platinum given in the foregoing table can be reduced to terms of refined metals used by the industries.

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[4] Chemical Trade Journal and Chemical Engineer, vol. 89, Oct. 30, 1931, p. 434.

[5] Engineering and Mining Journal, World Platinum Accord Announced in London: Vol. 132, Nov. 9 1931, p. 428.

Average assay of crude platinum, in per cent

Country	Platinum	Palladium	Iridium	Osmium	Rhodium, ruthenium, etc.
Australasia:					
New South Wales	75.9		1.3		1.3
Papua			58.1	33.5	3.0
Tasmania			58.1	33.5	3.0
Canada	72.1	0.2	1.1		2.8
Colombia	86.69	.54	[1].85		
Japan	.2		49.8	37.3	3.9
Russia	83.5	1.9	1.9	3.0	.6
United States	85.5	.6	1.1	1.3	1.0

[1] Iridium and osmiridium.

NOTES ON PRODUCTION BY COUNTRIES

UNITED STATES

The mine production of Alaska, as reported by the United States Geological Survey, amounted to 506 ounces of crude platinum in 1931, compared with 385 ounces in 1930. The production in both years was chiefly from placers in the Goodnews Bay region south of the mouth of Kuskokwim River; but some was from Dime Creek in the Koyuk district, Seward Peninsula.

In California mining companies reported the production of 354 ounces of platinum in 1931, compared with 129 ounces in 1930.

The production of platinum in Oregon in 1931 was 25 ounces, compared with 13 ounces in 1930.

AUSTRALASIA

Production of platinum metals in Australasia in 1931 was as follows: 283 ounces of platinum from New South Wales (155 ounces in 1930), ½ ounce of platinum from New Zealand (2½ ounces in 1930), 47 ounces of osmiridium from Papua (29 ounces in 1930), and 1,280 ounces of osmiridium from Tasmania (953 ounces in 1930).

All the platinum produced in New South Wales in 1930 was from the Fifield division.[6] At the end of 1930 about 35 men were prospecting and fossicking.

CANADA

The production of crude platinum from placers in Canada in 1931 was 20 ounces, compared with 17 ounces in 1930.[7] Recoveries of platinum metals in 1931 from the copper-nickel ores of the Sudbury area amounted to 44,725 ounces of platinum, 39,313 ounces of palladium, and 7,605 ounces of other platinum-group metals, compared with 34,000 ounces of platinum, 29,907 ounces of palladium, and 4,133 ounces of other platinum-group metals in 1930. The production of platinum metals in British Columbia in 1931 was 50 ounces, compared with 76 ounces in 1930.

Except for a few ounces of platinum obtained from the black sands of British Columbia and a small amount as an impure residue in the refining of gold at Trail, British Columbia, all the Canadian platinum and allied metals are obtained from the treatment of Sudbury nickel-copper matte.[8]

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[6] New South Wales Department of Mines, Annual Report for the Year 1930: Sydney, 1931, p. 30.

[7] Dominion Bureau of Statistics, Preliminary Report on the Mineral Production of Canada during the Calendar Year 1931: Ottawa, 1932.

The extensions to the precious-metals refinery at Acton, England, which was described in the 1930 chapter of this series, were officially opened on April 4, 1931. Some features of the plant, the refining process employed, and other information are given in a recent article,[9] from which the following paragraphs are quoted.

> * * * Within the empire we are able to produce the bulk of the platinum metals employed by the world. It is estimated that of a world consumption of some 400,000 ounces, approximately 300,000 will be produced in England from the Canadian nickel-copper ores found in the Sudbury district of Ontario.
>
> The refinery has already been in existence since 1924, when rich concentrates from the carbonyl process used at the Clydach nickel works were refined. Since then, crude platinum from South Africa was also treated, and now that the fusion of the International Nickel Co. (Inc.) and the Mond Nickel Co. has taken place, enlargements of the Acton refinery were found to be necessary to deal with the concentrates from the electrolytic nickel refinery at Port Colborne, in Ontario. The recently discovered deposits in the Frood mine in Canada have increased enormously the available nickel deposits, and consequently the company's resources in the platinum metals.
>
> There are, in consequence, two types of concentrate which are treated at the refinery. Firstly, the Clydach concentrate for the treatment of which the refinery was originally constructed and which contained 4 per cent of platinum metals (a richer concentrate is now obtained) and, secondly, the Port Colborne concentrate containing as much as 50 per cent of platinum metals. Nevertheless, the original processes and plant were so flexible that both are efficiently dealt with. The Clydach material therefore receives a preliminary concentration, as will be seen, by an initial smelting process. Thence both Clydach and Port Colborne concentrates pass through "wet" processes of solution and precipitation.
>
> In order that synthetic alloys made from these precious metals may have constant physical and chemical properties, it is important that the metals should have a high initial degree of purity. The following figures indicate the average purity obtained: Platinum, 99.93 per cent; palladium, 99.94 per cent; iridium, 99.7 per cent; rhodium, 99.7 per cent; ruthenium, 99.7 per cent; gold, 99.97 per cent; silver, 99.97 per cent.
>
> Considered in relation to the high recovery, these figures are all the more striking.
>
> It will be clear that in the treatment of precious metals, supervision and standing charges must be relatively high, so that the ultimate costs of refining are greatly influenced by the scale of operations. On the present scale, the cost of refining platinum metals works out at about 10s. per ounce, without any appreciable increase in the cost of producing the base metals, nickel and copper.
>
> It will be clear, also, that the high intrinsic value of the materials treated makes it imperative to reduce working losses to a minimum and to obtain the maximum yield as quickly and directly as possible. In practice, not more than ½ per cent of the platinum metals contained in the concentrates is lost, while 2½ per cent is temporarily retained in furnace slags which are returned to the nickel refinery for re-treatment.

COLOMBIA

The exports of crude platinum from Colombia in 1931 were 44,311 ounces; 29,075 ounces were the product of dredges and 15,236 ounces the product of hand working by native operators. Refiners of platinum metals in the United States reported purchases of 29,611 ounces of Colombian crude platinum in 1931, compared with 40,520 ounces in 1930.

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[8] Canada Department of Mines, Mines Branch, The Canadian Mineral Industry in 1931: Ottawa, 1932, p. 12.

[9] Industrial Chemist, A Precious Metal Refinery at Acton: Vol. 7, No. 76, May, 1931, pp. 207-208.

The South American Gold & Platinum Co. in 1931 produced 35,342 ounces of crude platinum and 9,736 ounces of gold, compared with 27,573 ounces of crude platinum and 9,048 ounces of gold in 1930.

By a decree of the Colombian Government the export tax on platinum has been reduced from 10 to 5 per cent of the value.[10]

(ETHIOPIA ABYSSINIA)

The production of crude platinum in Ethiopia in 1931 was 6,430 ounces, compared with 8,038 ounces in 1930.

RUSSIA

No authentic statistics on the production of platinum in Soviet Russia in 1930 and 1931 are available. In 1930 Russia was credited with a production of 120,000 ounces by one source [11] and of 125,000 ounces by another.[12]

SIERRA LEONE

The production of crude platinum in Sierra Leone in 1931 was 594 ounces, compared with 546 ounces in 1930.

An interesting contribution to the literature on platinum in Sierra Leone was made during 1931 by Pollett.[13]

UNION OF SOUTH AFRICA

The shipments of platinum in South Africa in 1931 were 36,545 ounces, valued at £217,807 (£5.96 an ounce), compared with 47,021 ounces, valued at £327,884 (£6.97 an ounce), in 1930.

The shipments of osmiridium in 1931 were 6,199 ounces, valued at £63,174 (£10.19 an ounce), compared with 5,619 ounces, valued at £69,267 (£12.33 an ounce), in 1930. Details of the production and sales of osmiridium in 1930 follow.[14] Detailed data for 1931 are not available.

Production and sales of osmiridium in South Africa in 1930, by districts

District	Production (ounces)	Sales	
		Ounces	Value
Witwatersrand:			
Large mines	5, 187. 078	5, 074. 475	£61, 916
Metallurgical works	518. 794	518. 794	7, 030
Heidelberg	26. 150	26. 150	321
	5, 732. 022	5, 619. 419	69, 267

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[10] Die Metallbörse, vol. 22, Feb. 10, 1932, p. 180.

[11] Mining Journal (London), vol. 172, Jan. 24, 1931, p. 8.

[12] American Chamber of Commerce in France, Foreign Trade, vol. 6, July, 1931, p. 29.

[13] Pollett, J. D., Platinum Mining in Sierra Leone: Eng. and Min. Jour., vol. 132, Nov. 9, 1931, pp. 407–408.

[14] Union of South Africa, Department of Mines and Industries, Annual Report of the Government Mining Engineer for the Calendar Year ended Dec. 31, 1930: Pretoria, 1931.

Composition of osmiridium sold in South Africa in 1930

Metal	Per cent	Weight of metal (troy ounces)	Metal	Per cent	Weight of metal (troy ounces)
Osmium	31.66	1,779.073	Rhodium	0.46	26.129
Iridium	27.22	1,529.768	Gold	1.72	96.618
Ruthenium	13.31	746.880	Balance (undetermined)	13.76	773.786
Platinum	11.87	667.165			
				100.00	5,619.419

In addition to the platinum contained in the osmiridium recovered in the treatment of gold ores, mining for platinum was carried on during 1930 in the Potgietersrust, Lydenburg, and Rustenburg districts. The output of these districts in 1930 follows.

Production of platinum in the Potgietersrust, Lydenburg, and Rustenburg districts in 1930

	Quantity	Assay	Estimated contents platinum metals (ounces)
Crude platinum	144,704.565 ounces	34.12 per cent	49,375.476
Concentrates	741.070 tons	8.05 ounces per ton	5,966.811
			55,342.287

Composition of platinum sold in South Africa in 1930

Metal	Ore (per cent)			Weight of metal (troy ounces)
	Dunite	Norite	Average	
Platinum	93.65	76.98	80.96	38,068.147
Palladium	1.97	15.81	12.51	5,880.212
Iridium	.85	.05	.24	111.719
Osmium and osmiridium		.59	.45	213.023
Rhodium	2.12	.17	.64	300.165
Ruthenium	1.27	.22	.47	221.911
Gold	.14	6.18	4.73	2,226.191
	100.00	100.00	100.00	47,021.368

Sales of osmiridium and platinum in South Africa since the beginning of operations are shown in the following table.

Sales of osmiridium and platinum in South Africa, 1921–1931, in ounces

Year	Osmiridium	Platinum	Year	Osmiridium	Platinum
1921–1926	19,578	4,951	1930	5,619	47,021
1927	5,653	10,431	1931	6,199	36,545
1928	5,991	17,828			
1929	5,712	21,608		48,752	138,384

As shown in the foregoing table, sales of osmiridium in South Africa in 1931 were 8 per cent larger than in 1930. Sales of platinum, however, were 22 per cent smaller than in 1930.

The South African Mining and Engineering Journal,[15] which feared that "the enlargement of the Acton refinery (near London) of the International Nickel Combine must be taken as the writing on the wall so far as the South African industry is concerned," writes [16] as follows:

> The effect of Russian dumping [of platinum] in accordance with the 5-year plan has not yet been realized in South Africa. * * * The fact that the International Nickel Corporation is producing platinum as a by-product from its Acton works has tended to obscure the part played by Russian dumping. It is beginning, however, to be realized that the real cause of the steadily falling prices in the platinum market is the Russian product, which is sold regardless of cost of production or the general interests of producers.

Both of these fears have been allayed by the formation of the Consolidated Platinums (Ltd.), which will handle virtually all the new platinum production originating in Russia, Canada, South Africa, and Colombia, followed by the formation of a new company to take over the Eerstegeluk Mine of the P. P. Rust Platinum Co. and the Waterval Mine of the Waterval (Rustenburg) Platinum Mining Co. (Ltd.), the purpose of which is to reduce operations in order to comply with the agreement entered into with other platinum producers to work on a quota basis.

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[15] South African Mining and Engineering Journal, By-Product Platinum: Vol. 41, pt. 2, Sept. 13, 1930, p. 37.

[16] South African Mining and Engineering Journal, The Russian Menace to South African Industries: Vol. 42, pt. 1, May 16, 1931, p 301.

CHROMITE [1]

By L. A. Smith [2]

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INTRODUCTION

The world production of chromite in 1931 reflected the effect of the prolonged world economic depression by decreasing approximately one-third. Southern Rhodesia, New Caledonia, Yugoslavia, Union of South Africa, and Cuba produced 241,000 metric tons in 1931 compared with 374,500 tons in 1930, a decrease of 36 per cent. Exports from the main exporting countries likewise dropped about 46 per cent. The decreases were as follows: Southern Rhodesia, 49 per cent; British India, 66 per cent; New Caledonia, 29 per cent; Greece, 96 per cent; Yugoslavia, 11 per cent; Union of South Africa, 10 per cent; and Cuba, 64 per cent. Russia exported 14,412 metric tons of chromite during the first half of 1931 compared with 4,351 tons for the same period in 1930 and was probably the only large producing center to increase exports. Imports by the principal importing countries totaled about 300,000 metric tons during 1931 compared with 441,000 tons in 1930, a decrease of 32 per cent. Thus, the decreases in production, exports, and imports averaged more than 30 per cent, indicating a decrease of similar proportions in consumption.

The United States imported about 213,000 long tons of chromite in 1931 compared with 327,000 tons in 1930, a decrease of nearly 35 per cent, despite a decline of $1 to $2 in price. The decrease may be attributed to a marked drop in consumption of chromite in the refractory trades, to a decline in metallurgical consumption, and to withdrawals from stocks built up in 1930. Imports of refractory-grade ores decreased 56 per cent, compared with a 33 per cent decrease in imports of metallurgical ore. Domestic shipments of chromite were negligible.

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[1] Work on manuscript completed July, 1932.

[2] Unless otherwise stated, statistics in this report prepared by H. M. Meyer and data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

A summary of the world chromite industry in 1931 follows:

In Europe, Germany imported slightly less chromite than in 1930, but returns for the first few months of 1932 indicate larger receipts. Exports of chromium commodities from and imports of chromite into Norway and Sweden decreased. Information concerning Great Britain is not yet available. French imports of chromite increased during 1931, most of which were obtained from Soviet Russia. Production in Yugoslavia increased about 12 per cent, but exports decreased 11 per cent.

In Asia, exports from British India declined 66 per cent. No information is yet available regarding Japan and Turkey. Exports from Indo-China increased from 885 metric tons in 1930 to 2,135 tons in 1931.

In Africa, production in Southern Rhodesia decreased 60 per cent; sales in South Africa decreased 16 per cent, although actual production increased in 1931. The Chrome Corporation (Ltd.) merged with the Edmond Davis group to form the New African Chrome Mines (Ltd.), which will control most of the chromite production in Africa.

In Oceania, production in New Caledonia increased about 2 per cent.

CHROMITE MINING IN THE UNITED STATES

In the United States 762 long tons of chromite were mined, all in California, and 268 tons shipped during 1931 compared with 310 tons mined and 80 tons shipped during 1930. Shipments during 1931 were made by J. L. Williams from his mine near Foresthill, Placer County; by the United States Chrome Mines (Inc.), E. W. Bedford, from the Pilliken Mine, El Dorado County; by Robert McCormick from the McCormick Mine, Tuolumne County; and by N. H. Joyner from the Diamond Mine, Fresno County. The Diamond Mine, some 30 miles northwest of Coalinga, is reported to have ore averaging 55 per cent Cr_2O_3 in a serpentine gangue. This ore contains three chromium minerals—chromite, uvarovite, and kammererite.

Deposits of a good grade of chromite are reported near Yreka, Siskiyou County, Calif.

Further activity is evident in the Beartooth area, 13 miles south of Red Lodge, Mont. Experiments with beneficiation of the chromiferous deposits are being conducted (Arizona Mining Journal, vol. 15, No. 24, May 25, 1932, p. 30).

The following table shows the production and shipments of chromite in the United States, 1929 to 1931:

Crude chromite mined and shipped from mines in the United States (all from California), 1929–1931

Year	Ore containing 45 per cent or more chromic oxide			Ore containing 35 to 45 per cent chromic oxide			Total value
	Mined (long tons)	Shipped (long tons)	Value	Mined (long tons)	Shipped (long tons)	Value	
1929	383	182	$2,712	160	87	$1,264	$3,976
1930	235	80	1,905	75	----------	----------	1,905
1931	612	268	3,509	150	----------	----------	3,509

IMPORTS AND EXPORTS

The United States imported 212,528 long tons of chromite during 1931, a decrease of 114,089 tons or 35 per cent from 1930. The decrease in ores imported for refractory purposes was about 56 per cent and in ores imported for metallurgical purposes about 33 per cent, indicating that the chromite-consuming industries, which maintained their demand during 1930, were no longer able to withstand the increasing intensity of the economic depression. Imports of ores from New Caledonia, used largely for chemical purposes, increased 28 per cent. Imports from Russia also increased about 28 per cent, while those from Rhodesia decreased 53 per cent. Imports from Cuba declined 64 per cent; from Greece, 37 per cent; from Union of South Africa, 78 per cent; and from India, 40 per cent.

The following table shows the percentage of the total imports of chromite coming from the most important producing countries, 1929 to 1931:

Crude chromite imported into the United States from the seven most important sources, 1929–1931, in per cent of total

Country	1929	1930	1931	Country	1929	1930	1931
Southern Rhodesia	52.70	44.61	32.13	British India	6.62	4.45	4.08
New Caledonia	8.45	9.50	18.62	Union of South Africa	5.52	7.46	2.53
Greece	8.39	14.03	13.59				
Russia	--------	4.25	8.35		98.35	96.85	86.34
Cuba	16.67	12.55	7.04				

The following table shows the imports of crude chromite into the United States by countries, 1927 to 1931:

Crude chromite imported into the United States, 1927–1931, by countries

[General imports]

Country	1927 (long tons)	1928 (long tons)	1929 (long tons)	1930 (long tons)	1931		
					Long tons		Value
					Gross weight	Chromium content	
Africa:							
British—Union of South	6, 935	15, 745	17, 545	24, 376	5, 379	2, 520	$31, 384
Portuguese—							
Mozambique	128, 851	112, 073	167, 381	145, 709	68, 291	34, 908	1, 077, 769
Other	21, 263	4, 000	----------	2, 000	2, 000	900	30, 416
Belgium	----------	----------	1, 367	1, 595	482	235	16, 760
Brazil	729	320	462	10	----------	----------	----------
Cuba	16, 983	33, 707	52, 949	40, 982	14, 957	6, 483	136, 040
Germany	----------	----------	1, 700	----------	----------	----------	----------
Greece	22, 527	17, 152	26, 647	45, 822	28, 893	13, 533	528, 807
Guatemala	----------	----------	----------	89	91	31	1, 346
India (British)	13, 572	17, 591	21, 033	14, 542	8, 664	4, 081	101, 767
Malta, Gozo, and Cyprus	----------	600	----------	----------	----------	----------	----------
Netherlands	----------	50	----------	----------	----------	----------	----------
Oceania (French)	11, 500	15, 154	26, 846	31, 022	39, 579	19, 135	602, 209
Soviet Russia in Europe	----------	----------	----------	13, 878	17, 736	7, 688	292, 094
Turkey in Asia	----------	200	1, 700	2, 591	2, 198	1, 080	44, 609
United Kingdom	----------	----------	----------	4, 001	24, 258	12, 121	451, 575
	222, 360	216, 592	317, 630	326, 617	212, 528	102, 715	3, 314, 776

The following tables show the imports of chromium alloys and compounds into the United States during the past five years:

Ferrochrome or ferrochromium and chrome or chromium metal imported for consumption in the United States, 1927–1931, in long tons

	1927	1928	1929	1930	1931
Ferrochrome or ferrochromium:					
Containing 3 per cent or more carbon (chromium content)	1	69	37	------	------
Containing less than 3 per cent carbon, gross weight	143	611	638	153	135
Chrome or chromium metal	10	10	21	------	------

Chromium compounds imported for consumption in the United States, 1927–1931

Year	Chromic acid		Chromate and bichromate of potash		Chromate and bichromate of soda		Chromium chloride and sulphate	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1927	15, 620	$9, 755	5, 007	$906	330	$67	40, 650	$2, 419
1928	99, 617	24, 547	6, 866	1, 112	1, 752	287	110	33
1929	462, 486	84, 683	8, 880	1, 537	350	80	3, 823	509
1930	177, 140	24, 788	1, 043	347	301	84	----------	----------
1931	1, 525	427	4, 814	769	63	16	100	74

Imports of chromic acid in 1931 decreased about 99 per cent in both quantity and value, and imports of chromate and bichromate of potash increased 362 per cent in quantity. Exports of sodium chromate and bichromate amounted to 4,407,460 pounds, valued at $287,794, in 1931 compared with 4,932,528 pounds, valued at $326,696, in 1930.

CONSUMPTION

Owing to lack of data concerning consumers' stocks it is not possible to give figures covering the consumption of chromite in the United States. The following table, however, gives the apparent available supply (imports plus domestic production), 1927 to 1931.

According to these figures the apparent available supply of chromite decreased 35 per cent in 1931.

Domestic sales, imports, and supply of crude chromite in the United States, 1927–1931, in long tons

Year	Sales from domestic mines	Imports (general)	Apparent available supply
1927	[1] 201	222, 360	222, 561
1928	660	216, 592	217, 252
1929	269	317, 630	317, 899
1930	80	326, 617	326, 697
1931	268	212, 528	212, 796

[1] According to the Division of Mines and Mining, Department of Natural Resources, California.

USES

METALLURGICAL

Continued adverse economic conditions led to a decrease in the production of alloy-steel ingots during 1931. The production of the high-chromium (8 to 30 per cent) alloys held up fairly well in 1930 but in 1931 declined somewhat, although the decrease was probably proportionately less than that in other alloy-steel ingots. Such alloys as "18–8" (18 per cent chromium and 8 per cent nickel) held up fairly well, but the larger production of low-chromium steels (0.5 to 7 per cent) probably dropped, due to curtailment in the automobile and structural-steel manufacturing industries.

One of the promising metallurgical advances in recent years has been the improvement of the nitriding process for case-hardening steels. Research has shown that nitrided alloys can be utilized effectively in such appliances as seats, disks and rings for steam valves, water-pump shafts, pressure-gage parts, piston pins, screw-down nuts for rolling mills, molds for rubber, herringbone reduction gears, shifts for gasoline pumps, shoe-machinery parts, heater bars, mechanical knives, connecting rods, cylinder linings, bushings, plungers, valves for air compressors, case register parts, and other appliances where a hard, durable surface is desired. Among the recent discussions relative to nitriding are the following:

Cunningham, W. H., and Ashbury, J. S. Surface Hardening by Nitrogen of Special Aluminum-Chromium-Molybdenum Steels on a Production Basis. Iron and Coal Trades Review, London, vol. 123, No. 3318, Oct. 2, 1931, pp. 492–494.

Higgins, J. H. Problems Confronting the Practical Nitrider. Steel, vol. 127, No. 14, Apr. 2, 1931, pp. 1080–1081.

Knapp, J. H. Temperature Control a Feature of New Nitriding Furnace. Steel, vol. 88, No. 8, Feb. 19, 1931, pp. 38–40.

Grossmann, M. A. Present and Future of Nitriding Appraised. Iron Age, vol. 127, No. 23, June 4, 1931, pp. 1823–1825.

REFRACTORIES

Imports of chromite from Cuba, Greece, and the Union of South Africa decreased from 111,180 long tons in 1930 to 49,229 tons in 1931. These ores usually run between 33 and 43 per cent Cr_2O_3, and as they are used largely for refractory purposes a decrease of about 56 per cent in shipments to refractory-manufacturing concerns is indicated. On the other hand, consumers may have begun drawing on stocks created in 1930 under what were then considered good buying conditions. Repairing of furnaces, done in some cases in order that the reconditioned furnaces might be ready for operation when the consumption of steel increased, was evidently terminated or curtailed by retrenchment programs.

Investigators in England[3] found that diaspore added to chromite refractories causes much less shrinkage than either chromite or diaspore alone and decreases the tendency toward spalling. The utilization of chromite brick has been increasing steadily in competition with magnesite brick, as shown in a summary by P. M. Tyler.[4]

The price of chromite refractory brick was steady at $45 per long ton, f. o. b. shipping point. Greek refractory ore, containing 37 to 42 per cent Cr_2O_3, was quoted at 40 cents per unit throughout 1931.

CHEMICALS

CHROMIUM PLATING

The latest figures released by the Bureau of the Census on production of chromic acid are given in the 1930 chapter of this series, page 251.

Much progress has been made in the technology of electroplating and in the uniformity of the product. Larger units and automatic control have aided in reducing costs and improving products. One essential factor in the advance of a given commodity is creation of public interest in it, and this seems to have been done.

BICHROMATES AND CHROMATES

According to the Bureau of the Census, the production of sodium bichromate and chromate amounted to 39,301 short tons, valued at $5,137,346, in 1929.

In 1931, the quoted price[5] of potassium bichromate averaged around 8¾ cents per pound until the end of November and stood at 8¼ to 8¾ cents at the end of the year. Sodium bichromate was constant at 7 cents per pound during 1930 and until the end of October, 1931, declining to 6½ to 7 cents per pound in November and ending the year at 5 to 5¼ cents in large orders; small spot orders were quoted at 5¾ cents. Chromic acid ranged from 14 to 15½ cents per pound during 1931.

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[3] The Times Trade and Engineering Supplement, Chromite and Magnesite Bricks: Vol. 29, No. 708, Jan. 30, 1932, p. 14.

[4] Tyler, P. M., Magnesite: Inf. Circ. 6437, Bureau of Mines, 1931, p. 5.

[5] Oil, Paint and Drug Reporter, Mar. 11, 1932, p. 61.

PIGMENTS

Data relative to the production of chromium pigments during 1927 and 1929 are given in the 1930 chapter of this series, page 252.

The quoted price [6] of chrome green, c. p. (light), was constant during 1930 at 27 cents per pound; but in April, 1931, it was fixed at 23 cents and remained at that figure until the end of December.

Commercial green remained constant during 1930 and 1931 at 6¼ cents per pound.

Chrome yellow, c. p., remained steady at 16½ cents per pound until the end of September, when it shifted to 16 to 16½ cents; the price remained at that figure until the end of the year.

PRICES [7]

The quoted price of 46 to 48 per cent Indian and Rhodesian ores, c. i. f. Atlantic seaboard, was $19.50 per long ton during January but thereafter was $19 until July, when it dropped to $17, partly recovering to $17.50 in September, where it remained until the end of the year. Indian and New Caledonian 50 to 51 per cent ore opened at $24 but dropped to $23.50 to $24 during the last week in January, remaining at that figure until early in July; the price then dropped to $19.50 to $20, where it remained until the end of the year.

Ferrochromium containing 65 to 70 per cent chromium and 4 to 6 per cent carbon was quoted throughout the year at 11 cents per pound of contained chromium on required contracts. Spot shipments commanded an extra half cent. Ferrochromium containing 65 to 72 per cent chromium and 0.1 to 2 per cent carbon was quoted at 17½ cents on contract, and ferrochromium containing under 0.1 per cent carbon was quoted at 26 cents.

WORLD ASPECTS

WORLD TRADE IN CHROMITE, 1929 AND 1930

A study of the flow of chromite in 1930, the latest year for which final data are available, shows that five of the six main producing countries consume little chromite and that the main consuming countries except Russia produce negligible amounts. These facts illustrate how an important manufacturing industry may depend largely upon imported raw materials.

The total world production of chromite in 1930 amounted to about 550,300 long tons compared with 624,100 tons in 1929, a decrease of 12 per cent. During 1930, Southern Rhodesia, New Caledonia, British India, Cuba, Russia, Turkey, and Yugoslavia furnished about 90 per cent of the total output compared with 84 per cent in 1929. Total world exports amounted to 420,200 long tons in 1930 compared with 503,000 tons in 1929, a decrease of 16 per cent. During 1930 the aforementioned seven countries contributed 88 per cent of the total world exports compared with 87 per cent during 1929. The total imports during 1930 amounted to about 434,200 long tons compared with 444,000 tons during 1929, a decrease of 2 per cent. The United States, Germany, the United Kingdom, Sweden, Norway, and France took 98 per cent of the total in 1930 and 97 per cent in 1929. The apparent consumption in 1930 was about 497,500 long tons compared with 501,700 tons in 1929, a decrease of less than 1 per cent. The five largest importing countries and Russia accounted for about 94 per cent of the world's apparent consumption in 1930 compared with 93 per cent in 1929. The following table shows the amount of chromite produced, exported, imported, and consumed by the principal countries in 1930:

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[6] Oil, Paint and Drug Reporter, Mar. 11, 1932, pp. 31-36.

[7] Engineering and Mining Journal, Metal and Mineral Markets: Vol. 2, Nos. 1-52, 1931 (Weekly Market-News Service).

Chromite produced, exported, imported, and consumed by principal countries in 1930

[The figures show the actual and relative position of producing countries in world production and exports of chromite in comparison with actual and relative imports and apparent consumption in principal countries]

Country	Production		Exports		Imports		Apparent consumption [1]	
	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total
Southern Rhodesia	202,400	36.9	171,700	40.9	---------	---------	---------	---------
Russia	65,700	11.9	14,800	3.5	---------	---------	50,900	10.2
New Caledonia	60,900	11.1	52,900	12.6	---------	---------	---------	---------
Yugoslavia	50,800	9.2	32,500	7.7	---------	---------	[2] 1,000	.2
British India	50,700	9.2	30,000	7.1	---------	---------	200	---------
Cuba	41,000	7.4	41,000	9.8	---------	---------	---------	---------
Turkey	27,900	5.1	27,900	6.6	---------	---------	---------	---------
Greece	23,000	4.2	24,000	5.7	---------	---------	---------	---------
Union of South Africa	13,500	2.5	22,700	5.4	---------	---------	---------	---------
Japan	11,200	2.0	---------	---------	---------	---------	11,200	2.3
Cyprus	1,500	.3	1,500	.4	---------	---------	---------	---------
Indo-China	1,400	.2	900	.2	---------	---------	---------	---------
Australia	200	---------	---------	---------	---------	---------	200	---------
United States	100	---------	---------	---------	326,600	75.2	326,700	65.7
Germany	---------	---------	---------	---------	28,400	6.5	28,400	5.7
Sweden	---------	---------	---------	---------	25,800	5.9	25,800	5.2
Norway	---------	---------	---------	---------	19,500	4.5	19,500	3.9
United Kingdom	---------	---------	300	.1	16,700	3.9	16,400	3.3
France	---------	---------	---------	---------	[2] 10,000	2.3	[2] 10,000	2.0
Czechoslovakia	---------	---------	---------	---------	1,800	.4	1,800	.4
Poland	---------	---------	---------	---------	400	.1	400	.1
Other countries	---------	---------	---------	---------	[2] 5,000	1.2	[2] 5,000	1.0
	550,300	100.0	420,200	100.0	434,200	100.0	497,500	100.0

[1] Producers' and consumers' stocks not taken into account except in the case of countries where consumption is known to be negligible.

[2] Estimated.

WORLD PRODUCTION OF CHROMITE IN 1931

As production data are missing for Greece, Russia, and Japan, it is difficult to estimate world production in 1931. If it is assumed that these countries dropped in the same ratio as Southern Rhodesia, New Caledonia, Yugoslavia, and Cuba, world production probably was roughly 330,000 to 340,000 metric tons in 1931 compared with 559,000 tons in 1930. The production of Southern Rhodesia, New Caledonia, Yugoslavia, Union of South Africa, and Cuba amounted to 241,000 metric tons in 1931 compared with 374,500 tons in 1930, a decrease of 36 per cent. Decreases of at least similar proportions are indicated for Greece and India by the fall in exports.

Production of crude chromite, 1927–1931, by countries, in metric tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1927	1928	1929	1930	1931
Australia			131	171	26
Brazil [1]	1,820	20	70	10	
Canada (shipments)			114		
Cuba [2]	17,256	34,248	53,799	41,640	15,197
Cyprus (shipments)	723		2,483	1,532	(3)
Great Britain	384				
Greece	17,314	20,953	24,214	23,402	(3)
Guatemala [2]				90	92
India (British)	58,125	46,185	50,361	51,497	(3)
Indo-China			11	1,451	2,800
Japan	9,782	9,808	9,163	11,348	(3)
New Caledonia	[1] 42,885	56,902	52,594	61,894	63,000
Russia [4]	19,294	29,536	52,889	66,720	(3)
Southern Rhodesia	197,782	199,060	265,909	205,631	81,623
Turkey (Asia Minor)	18,318	11,849	15,078	28,325	25,388
Union of South Africa	16,959	31,756	63,974	13,726	23,335
United States (shipments)	204	671	273	81	272
Yugoslavia	8,757	16,678	43,022	51,576	57,871
	409,600	457,700	634,100	559,100	(3)

[1] Exports.
[2] Imports into the United States.
[3] Data not available.
[4] Year ended Sept. 30.

SUMMARY OF PRODUCTION AND CONDITIONS IN PRINCIPAL CHROMITE PRODUCING AND CONSUMING REGIONS OF THE WORLD

NORTH AMERICA

Cuba.—Imports into the United States from Cuba, which roughly represent total shipments, amounted to 15,197 metric tons in 1931 compared with 41,640 tons in 1930, a decrease of 64 per cent. The Bethlehem Cuba Iron Mines Co. produced 12,635 metric tons of ore in 1931 and shipped 15,109 metric tons, leaving a stock on hand on December 31, 1931, of about 217 tons. This material averaged about 32 per cent Cr_2O_3, about 12 per cent iron, and 2.5 per cent silica.

EUROPE

Czechoslovakia.—Imports of chromite[8] into Czechoslovakia amounted to 725 metric tons in 1931 compared with 1,842 tons in 1930.

France.—Imports[9] of chromite into France during the first 11 months of 1931 amounted to 12,460 metric tons, and according to Vice Consul J. J. Coyle[10] (Paris), Soviet chromite comprised the bulk of French imports during 1931.

Germany.—Germany imported 27,530 metric tons of chromite in 1931 compared with 28,888 tons in 1930. The following table shows the imports of chromite into Germany, 1929 to 1931:

Chromite imported into Germany, 1929–1931, by countries, in metric tons[a]

Country	1929	1930	1931	Country	1929	1930	1931
British South Africa	19,594	13,366	15,645	Greece	407	324	
New Caledonia	8,603	4,515	5,222	Spain	4,521		
Australasia	213			Russia	1,203		
Turkey	421	1,622	4,779	Other countries	1,544	1,285	464
Yugoslavia	2,576	2,541	1,125				
British India	761	625	210		41,695	28,888	27,530
Portuguese East Africa	1,852	4,610	85				

[a] Monatliche Nachweise über den auswärtigen Handel Deutschlands, December, 1931, Berlin, 1932, and annual reports for 1929 and 1930.

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[8] Commerce Extérieur de la République Tchécoslovaque, Monthly Summary, December, 1931 (or Zpravy Státního Uradu Statistickéno, Republiky Československé).
[9] Metal Bulletin (London), No. 1665, Feb. 5, 1932, p. 15.
[10] Ms. Consular Report 47772 (10984), Paris, France, May 18, 1932.

Imported chromite enters about the same channels of consumption in Germany as in the United States. Germany manufactures an excess of chromates and bichromates, exports of which amounted to 6,186 metric tons in 1930 compared with 6,665 tons in 1929.

A recent communication[11] from Consul General W. L. Lowrie (Frankfurt am Main, Germany) outlines the chrome-plating advances in Germany during 1930 and 1931.

Chromates[12] or chromic acid are said to be a patented feature of a new German wood preservative in which their property of fixing arsenic in wood is utilized.

Greece.—The production of chromite in Greece during 1930 amounted to 23,402 metric tons compared with 24,214 tons in 1929, a decrease of 3 per cent.

The following table shows the exports of chromite from Greece, 1928 to 1931:

Chromite exported from Greece, 1928–1931, by destinations, in metric tons[1]

Destination	1928	1929	1930	1931
Belgium	100			
United States	12, 750	17, 170	24, 380	1, 000
Other countries	4, 412	2, 951	54	7
	17, 262	20, 121	24, 434	1, 007

[1] Bull. Min. du Com. Spécial de la Grèce avec les Pays Étrangers, December, 1931 (January to December summary), Athens, 1932, p. 83.

Imports into the United States from Greece during 1931 amounted to 29,357 metric tons compared with 46,557 tons in 1930. It is quite probable that the bulk of the 1931 imports represents ore transshipped from Yugoslavia through the port of Saloniki.

Norway.—Norway [13] imported 9,206 metric tons of chromite during 1931 compared with 19,797 tons in 1930. Imports during 1930 came largely from India and Southern Rhodesia. Exports of ferrochromium amounted to 4,856 metric tons in 1931 compared with 4,141 tons in 1930.

Russia.—Production in Soviet Russia [14] during the fiscal year 1929–30 amounted to 66,720 metric tons compared with 52,889 tons during 1928–29.

Russian export figures on chromite [15] are now reported on a calendar-year basis; exports for the first six months of 1931 were 14,412 metric tons compared with 4,351 tons for the same period in 1930. Exports during the calendar year 1930 were 15,046 tons compared with 8,639 tons in 1929. The United States imported 18,021 metric tons from Russia in 1931 and 14,101 tons in 1930.

The Zaporozhye ferro-alloy plant will employ electric furnaces to produce ferrochromium and other ferro-alloys.

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[11] Lowrie, W. L., Consul General, Chrome Plating in Germany: World Trade Notes, Bur. Foreign and Domestic Commerce, vol. 5, No. 46, Nov. 16, 1931, p. 1.

[12] Lowrie, W. L., Consul General, Arsenic-Chromium Wood Preservative: World Trade Notes, Bur. Foreign and Domestic Commerce, vol. 6, No. 16, Apr. 18, 1932, p. 3.

[13] Norges Offisielle Statistikk, Månedsopgaver over Vareomsetningen med Utlandet (December, 1931): Oslo, 1932, pp. 228, 229, and 237.

[14] Economic Review of the Soviet Union, Production and Export of Chromite: Vol. 7, No. 9, May 1, 1932, pp. 199-200 (Amtorg Trading Corporation, 261 Fifth Ave., New York).

[15] Information furnished by Russian division of the Bureau of Foreign and Domestic Commerce, U. S. Dept. of Commerce.

Sweden.—Imports [16] of chromite into Sweden in 1931 totaled 16,220 metric tons compared with 26,303 tons in 1930. The following table shows the imports of chromite into Sweden, 1928 to 1930.

Chromite imported into Sweden, 1928–1930, by countries, in metric tons [1]

Country	1928	1929	1930	Country	1928	1929	1930
Germany	3,345	13,320	21,615	British India	502	611	--------
Turkey in Asia	--------	1,125	2,494	Brazil	--------	161	--------
Russia	280	682	1,655	Other countries	290	8	--------
Belgium	314	1,207	519				
Netherlands	--------	--------	20		28,077	24,225	26,303
United Kingdom	23,346	7,111	--------				

[1] Sveriges Officiella Statistik: "Handel" for 1928, 1929, and 1930, Commodity Part I, 20a, Stockholm 1931, p. 117.

United Kingdom.—Imports of chromite into the United Kingdom, 1928 to 1930, are shown in the following table:

Chromite imported into the United Kingdom, 1928–1930, by countries, in long tons [1]

Country	1928	1929	1930	Country	1928	1929	1930
Southern Rhodesia	5,403	7,658	13,486	Portuguese India	2,037	--------	--------
British India	1,824	1,000	1,400	Other British colonies	1,250	2,485	--------
Portuguese East Africa	11,064	11,894	[2] 1,173	Other countries	808	2,911	444
New Caledonia	--------	1,328	153				
					22,386	27,276	16,656

[1] Annual Report of the Trade of the United Kingdom with Foreign Countries and British Possessions, London, 1930 and 1931.

[2] Transshipped from Union of South Africa.

Yugoslavia.—Yugoslavia produced 57,871 metric tons of chromite in 1931 compared with 51,576 tons in 1930. Exports totaled 29,291 metric tons in 1931 compared with 33,060 tons in 1930. The following table shows the exports of chromite from Yugoslavia by destinations during the past three years:

Chromite exported from Yugoslavia, 1929–1931, by destinations, in metric tons [1]

Destination	1929	1930	1931	Destination	1929	1930	1931
United States	7,058	22,194	23,307	Greece	5,623	615	172
Switzerland	--------	--------	2,155	Austria	1,940	782	160
Germany	2,295	2,727	1,279	Rumania	30	1,800	120
France	1,150	4,002	1,058	Other countries	1,424	756	215
Czechoslovakia	1,925	184	825				
					21,445	33,060	29,291

[1] Statistique du Commerce Extérieur du Royaume de Ĵougoslavie, 1929, 1930, and 1931: Belgrade (Imprimerie Nationale, Ministère des Finances).

ASIA

India.—The production of chromite in India during 1930 amounted to 50,684 long (51,497 metric) tons compared with 49,565 long (50,361 metric) tons in 1929, an increase of about 2 per cent. However, the total exports in 1930 were only 29,978 long (30,459 metric) tons, leading to an increase of 20,706 long (21,038 metric) tons in producers' stocks. Exports from British Indian ports decreased from 22,498 long (22,859 metric) tons in 1930 to 7,708 long (7,832 metric) tons during 1931, a drop of 66 per cent.

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[16] Sveriges Officiella Statistik, "Handel" for 1929 and 1931, Part I, December, 1931: Stockholm, 1932, p. 267.

The following table shows the quantity and value of the chromite produced in India, 1929 and 1930:

Chromite produced in British India, 1929 and 1930, by States and districts

	1929		1930	
	Long tons	Value	Long tons	Value
Baluchistan: Zhob	17,905	£19,908	25,387	£27,998
Bihar and Orissa: Singhbhum	3,149	5,107	5,101	7,350
Mysore State:				
Hassan	22,799	27,756	13,106	16,813
Mysore	5,712	10,047	7,090	12,095
	49,565	62,818	50,684	64,256

The following table shows the exports of British Indian chromite, 1929 to 1931:

Chromite from British India exported, 1929–1931, in long tons

	1929	1930	1931
From British Indian ports to [1]—			
United States	5,250	7,450	2,750
Germany	10,300	5,000	1,750
United Kingdom	1,250	3,250	1,468
France	50	700	1,080
Other countries	1,309	6,098	660
Total from British Indian ports	18,159	22,498	7,708
From Portuguese Indian ports	14,243	[2] 7,480	(3)
Grand total	32,402	29,978	(3)

[1] Sea-Borne Trade and Navigation of British India for the calendar year of 1931, pp. 104–106.
[2] Rec. Geol. Survey of India, vol. 65, pt. 3, Calcutta, 1931, p. 319.
[3] Information not available.

Of the Indian production since 1914, Mysore State [17] has produced about 308,000 long tons, or about 50 per cent. The shipments from Mysore State since 1915 have totaled around 268,000 tons, of which the Hassan district furnished 80 per cent (about 214,000 tons) and the Mysore district 20 per cent (about 54,000 tons). Further discussion of the Mysore deposits is contained in the report quoted.

Indo-China.—Exports from Indo-China [18] amounted to 2,135 metric tons during 1931 compared with 885 tons in 1930 and 10 tons in 1929. Of the 1931 total, 701 tons went to France. The production in 1931 was 2,800 metric tons. Recent reports [19] indicate that the Société Chrome et Nickel de l'Indochine now has an ore-dressing plant capable of producing 1,000 tons of concentrate a month.

Turkey.—Production during 1931 was 25,388 metric tons compared with 28,325 tons in 1930. Practically all is usually exported.

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[17] Lewis, C. W., jr., American consul, Chromite Ore Production in Mysore: Ms. Cons. Rept. 47395 (11023), Madras, India, Apr. 30, 1932, 7 pp.

[18] Bulletin Économique de l' Indochine, Thirty-Fifth Year, Rapport sur la Navigation et le Mouvement Commercial de l'Indochine, Pendant l'Année 1931: Hanoi, 1932, p. 158.

[19] Karpinski, R. W., Mining in French Indo-China: Eng. and Min. Jour., vol. 133, No. 7, July, 1932, p. 367.

AFRICA

Southern Rhodesia.—Production of chromite in Southern Rhodesia decreased steadily month by month during the latter part of 1930 and 1931. The decline started when production decreased from 32,316 metric tons in July to 13,524 tons in August, 1930. This decline continued during the rest of the year, but in January, 1931, production rallied to 10,220 tons. After January, 1931, there was a constant decrease, which resulted in an output of only 3,965 tons in December, 1931. The total output for 1931 was 81,623 metric tons, compared with 205,631 tons in 1930, a decrease of 60 per cent. The price decline was relatively much less severe; but Rhodesia evidently was unable to hold its position in world markets in competition with lower-cost producing centers such as Turkey, Greece, New Caledonia, and Russia. Another factor, which is claimed to have been important, was Rhodesia's continued adherence to the gold standard.

Exports [20] of chromite from Southern Rhodesia amounted to approximately 90,000 metric tons during 1931 compared with 174,449 tons in 1930 and 255,173 tons in 1929.

The following table shows the exports of chromite from Southern Rhodesia, 1929 to 1931:

Chromite exported from Southern Rhodesia, 1929–1931, by destinations, in metric tons [1]

Destination	1929	1930	1931 [2]	Destination	1929	1930	1931 [2]
United States	186, 752	142, 659	64, 836	Belgium	944	1, 179	15
Portuguese East Africa	6, 894	5, 856	9, 655	Italy	2, 258	3, 861	------
Norway	4, 064	5, 080	6, 604	Netherlands [3]	2, 696	------	------
United Kingdom	47, 407	13, 040	6, 004	Other countries	91	------	119
France	816	1, 539	498				
Japan	711	781	203		255, 173	174, 449	88, 132
Germany	2, 540	454	198				

[1] Report of Comptroller of Customs and Excise, 1929 and 1930, Salisbury, Southern Rhodesia, 1931, p. 155.
[2] Letter from Consul M. K. Moorhead, Johannesburg, Union of South Africa, No. 356, May 17, 1932.
[3] Probably for transshipment to Germany and Scandinavia.

The major part of the decline in exports was due to decreased shipments to the United States and the United Kingdom. Exports to the United States during 1931 decreased 55 per cent and those to the United Kingdom 54 per cent; the decrease in shipments to these two countries was partly balanced by increases to Norway and Portuguese East Africa.

The most significant development of the year was acquisition of the controlling interest in the Rhodesian Chrome & Asbestos Co. (Ltd.) and the Chrome Corporation (Ltd.) by the African Chrome Mines (Ltd.) (Edmond Davis group), thus concentrating a large part of the South African chromite production under one large holding and operating company. The merged concerns have a combined capital of £800,000 in £1 shares.

Union of South Africa.—Sales of chromite amounted to 19,171 metric tons during 1931 compared with 22,894 tons in 1930, a decrease of 16 per cent. Exports amounted to 20,715 metric tons during 1931 compared with 23,033 tons in 1930, a decrease of 10 per cent.

The following table shows the exports of chromite from the Union of South Africa, 1929 to 1931:

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[20] Calculated on basis of exports for the 12 months ended December, 1931 (according to Trade of Southern Rhodesia, September, 1931).

Chromite exported from the Union of South Africa, 1929–1931, by destinations, in metric tons

Destination	1929 [1]	1930 [2]	1931 [3]
Netherlands	20, 511	13, 575	13, 489
United Kingdom	5, 472	2, 088	2, 702
United States	10, 288	5, 546	1, 109
Other countries	8, 445	1, 824	[4] 3, 415
	44, 716	23, 033	20, 715

[1] Trade of the Union of South Africa, Ann. Rept., 1929, Pretoria, 1930.
[2] Trade of the Union of South Africa, Monthly Statements: December, 1930, Pretoria, 1931.
[3] Letter from Consul M. K. Moorhead, Johannesburg, Union of South Africa, No. 356, May 17, 1932.
[4] Includes 2,467 tons to Germany, 482 tons to Belgium, and 466 tons to France.

The Chrome Corporation (Ltd.)[21] was forced to sell 93 per cent of its controlling interest in Transvaal chromite deposits to the African Chrome Mines (Ltd.) of London (Edmond Davis group). The officers of the new company are Sir Edmond Davis, Sir Abe Bailey, and S. H. Borlan.

A comprehensive article [22] on the magmatic origin of the Transvaal chromite deposits was recently published in Economic Geology.

OCEANIA

New Caledonia.—The production of chromite [23] in New Caledonia was about 63,000 metric tons in 1931 compared with 61,894 tons in 1930, an increase of about 2 per cent. Exports were 38,271 metric tons in 1931 compared with 53,747 tons in 1930, a decline of 29 per cent. Stocks on Tiébaghi Mountain were estimated at around 40,000 tons. Apparently, no particular concern was felt over the growing stocks or decreased exports, as the future market was believed to be favorable.

Exports during 1930 and 1931 went to the following countries:

Chromite exported from New Caledonia, 1930 and 1931, by countries of destination, in metric tons [1]

Destination	1930	1931
United States	32, 310	30, 018
Netherlands	16, 611	5, 689
France	2, 117	1, 038
Other countries	2, 709	1, 526
	53, 747	38, 271

[1] Roberts, Q. F., Mining Industry of New Caledonia: Ms. Cons. Rept. 44966 (8073), Suva, Fiji Islands, Mar. 14, 1932, p. 5.

Société la Tiébaghi exported 10,811 tons in 1931 compared with 28,000 tons in 1930. Société Chimique du Chrome shipped 15,158 tons in 1931.

Total exports from 1914 through 1931 included 417,495 tons by Société la Tiébaghi, 118,240 tons by Société Caledonia, and 91,478 tons by Société Chimique du Chrome (1925 to 1931, inclusive). The ore shipped by Société la Tiébaghi during 1931 averaged 56 per cent Cr_2O_3, that from Société Caledonia about 48 per cent, and that from Société Chimique du Chrome about 47 to 48 per cent. Existing reserves probably range from 1,000,000 to 1,500,000 tons of ore averaging over 50 per cent Cr_2O_3.

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[21] South African Mining and Industrial Magazine, vol. 42, No. 2107, Feb. 13, 1932, p. 598.
[22] Sampson, Edward, Magmatic Chromite Deposits in Southern Africa: Econ. Geol., vol. 27, No. 2, March–April, 1932, pp. 113–144.
[23] Roberts, Q. F., Mining Industry of New Caledonia: Ms. Cons. Rept. 44966 (8073), Suva, Fiji Islands, Mar. 14, 1932, p. 5.

IRON ORE, PIG IRON, AND STEEL[1]

By H. W. Davis[2]

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GENERAL REVIEW

In 1931 production and shipments of iron ore decreased 47 and 48 per cent, respectively, compared with 1930. The production in 1931 was 48 per cent of the average for the preceding 5 years and 53 per cent of the average for the preceding 10 years. The output of pig iron, including ferro-alloys, decreased 42 per cent compared with 1930. It was 49 per cent of the average for the preceding 5 years and 54 per cent of the average for the preceding 10 years.

The average value per ton of iron ore at the mines in 1931 was 4 cents less than in 1930. The average values at the furnaces of pig iron, ferromanganese, and spiegeleisen declined $1.12, $12.85, and

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[1] Work on manuscript completed June, 1932.

[2] Statistics on iron ore compiled by K. V. Herlihy, of the Bureau of Mines; data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, also of the Bureau of Mines.

$2.29 a ton, respectively, in 1931. Earnings of 20 of the leading steel manufacturers in the United States, according to Steel,[3] showed a return on capitalization of 0.4 per cent in 1931, compared with 4.54 per cent in 1930.

Iron Age[4] stated that for the second year in succession and the third time in five years building and other construction consumed more American steel than did any other form of activity, accounting for 18.5 per cent of the total compared with 19 per cent in 1930. The automotive industry again ranked second as a consumer of steel, taking 16 per cent in 1931 compared with 15.5 per cent in 1930. Railroads used 13.5 per cent of the total in 1931 compared with 15 per cent in 1930, and remained in third place. The oil, gas, water, mining, and lumbering industries consumed 11 per cent of the total, containers 9 per cent, agriculture 4.5 per cent, exports 4 per cent, and machinery 3 per cent.

The total domestic output of pig iron required about 35 per cent of the annual capacity, according to figures of the American Iron and Steel Institute, but this capacity was not utilized steadily. At the beginning of 1931, 97 furnaces were in blast; on June 30, 93; and at the end of the year only 61. The production of steel ingots is considered to have been about 37 per cent of the rated capacity, having ranged from about 53 per cent in March to about 23 per cent in December. The output of pig iron (including ferro-alloys) in the United States in 1931 represented about 33 per cent of the world production and was about 45 per cent less than that of the producing countries of Europe combined. The production of pig iron (including ferro-alloys) decreased 23 per cent in Europe in 1931 compared with a decrease of 42 per cent in the United States.

In common with practically all other branches of mineral production the iron-ore mining industry was again affected adversely by business conditions. In the Lake Superior district mining was less active than in any year since 1921, and the production was 53 per cent below the average for the previous five years. The production of iron ore in the Lake Superior district in 1931 exceeded shipments by about 2,600,000 tons. Eastern furnaces took only 20,000 tons of Lake ore in 1931 compared with 150,000 tons in 1930. Computation of iron-mining costs in Michigan in 1931 by the State mine appraiser showed that the operators' gross profit at underground mines was 13 cents a ton (60 cents a ton in 1930) and that the cost at siliceous open-pit mines in 1931 was 11 cents a ton more than the Lake Erie value in that year. The average daily wage at iron-ore mines in Michigan was $4.963 and the average yearly earning $843.71 compared with $4.997 and $1,436.55, respectively, in 1930. The average daily wage at iron-ore mines in St. Louis County, Minn., was $5.31 compared with $5.33 in 1930; the average daily wage at iron-ore mines in Itasca County, Minn., was $5.26 compared with $5.38 in 1930.

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[3] Steel: Vol. 90, Apr. 25, 1932, p. 20.

[4] Iron Age, Steel Consumed by Various Industries in 1931; Vol. 129, Jan. 7, 1932, pp. 11–12.

IRON ORE

QUANTITIES MINED AND SHIPPED

In the following tables the quantities of iron ore shown include ore that was beneficiated—that is, treated in any way—as well as crude ore not requiring treatment. Although included in the figures on production the iron ore sold for the manufacture of paint (5,514 gross tons in 1931, valued at $29,759, or $5.40 a ton, compared with 9,671 tons in 1930, valued at $53,520, or $5.53 a ton) is not included in the figures on shipments from mines. The output of manganiferous iron ore that contained 5 per cent or more of manganese amounted to 281,414 gross tons, valued at $976,549, compared with 785,390 tons, valued at $2,401,605, in 1930. In Arkansas one producer shipped 6 gross tons of loadstone, which is not included in the tabulated statistics of iron ore. Neither do the statistics include iron sinter recovered from copper sulphide ore mined in Tennessee.

Iron ore was mined in 15 States in 1931 compared with 17 States in 1930. Washington reentered the list of iron-ore producing States, and Arizona, North Carolina, and Virginia dropped out. The greater part of the iron ore mined in the United States is sold for use in the manufacture of pig iron and steel; but some ore produced in Michigan, New York, Pennsylvania, Utah, and Wisconsin was sold for use in making paint. The rank of the three States producing the largest quantity of iron ore—Minnesota, Michigan, and Alabama—remained unchanged. Minnesota is producing more iron ore than all the rest of the States together and has furnished a little less than 60 per cent of the total for the United States in the last five years.

The ores of iron are classed under four heads—hematite, brown ore, magnetite, and carbonate. Notes on the composition of these ores are given in Mineral Resources, 1916, Part I, pages 537–541.

Iron ore mined in the United States in 1931, by States and varieties, in gross tons

[Exclusive of ore containing 5 per cent or more of manganese]

State	Number of active mines	Hematite	Brown ore	Magnetite	Carbonate	Total
Alabama	14	3, 369, 481	245, 663			3, 615, 144
Colorado	1		26, 202			26, 202
Georgia	3		20, 745			20, 745
Michigan	55	7, 552, 581				7, 552, 581
Minnesota	67	17, 445, 003				17, 445, 003
Missouri	[1] 16	54, 139	58, 233			112, 372
New Jersey	5			293, 768		293, 768
New Mexico	10			168, 075		168, 075
New York	5	([2])		[2] 275, 075		275, 075
Pennsylvania	2			367, 299	818	368, 117
Tennessee	1		8, 717			8, 717
Utah	2	183, 668	400			184, 068
Washington	1			1, 032		1, 032
Wisconsin	3	879, 832				879, 832
Wyoming	1	180, 771				180, 771
Total, 1931	[1] 186	[2] 29, 665, 475	359, 960	[2] 1, 105, 249	818	31, 131, 502
Total, 1930	208	[2,3] 55,265,954	[3] 720, 496	[2] 2, 421, 211	1, 003	58, 408, 664

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[1] In addition, an undetermined number of small pits were worked at 212 properties in Missouri. The output from these pits is included in the figures given.

[2] Some hematite included with magnetite.

[3] Some hematite included with brown ore.

Iron ore mined in the United States, 1930 and 1931, by States and mining methods, in gross tons

[Exclusive of ore containing 5 per cent or more of manganese]

State	Open pit	Under-ground	Undis-tributed	Total
1930				
Alabama	587,389	5,151,089	----------	5,738,478
Arizona	----------	----------	923	923
Colorado	----------	32,247	----------	32,247
Georgia	52,221	----------	----------	52,221
Michigan	1,516,097	12,028,180	----------	13,544,277
Minnesota	25,522,212	8,995,536	----------	34,517,748
Missouri	----------	118,012	14,737	132,749
New Jersey	----------	394,639	----------	394,639
New Mexico	2,521	170,911	----------	173,432
New York	(1)	[1] 889,405	----------	889,405
North Carolina	----------	100	----------	100
Pennsylvania	711,977	252,661	----------	964,638
Tennessee	27,384	326	----------	27,710
Utah	277,974	1,144	----------	279,118
Virginia	19,596	----------	----------	19,596
Wisconsin	733	1,320,627	----------	1,321,360
Wyoming	257,444	62,579	----------	320,023
	[1]28,975,548	[1]29,417,456	15,660	58,408,664
1931				
Alabama	245,663	3,369,481	----------	3,615,144
Colorado	----------	26,202	----------	26,202
Georgia	20,745	----------	----------	20,745
Michigan	863,840	6,688,741	----------	7,552,581
Minnesota	12,055,312	5,389,691	----------	17,445,003
Missouri	70,093	20,366	21,913	112,372
New Jersey	----------	293,768	----------	293,768
New Mexico	67,695	100,380	----------	168,075
New York	(1)	[1] 275,075	----------	275,075
Pennsylvania	314,001	54,116	----------	368,117
Tennessee	8,717	----------	----------	8,717
Utah	184,068	----------	----------	184,068
Washington	----------	1,032	----------	1,032
Wisconsin	31	879,801	----------	879,832
Wyoming	----------	----------	180,771	180,771
	[1]13,830,165	[1]17,098,653	202,684	31,131,502

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[1] Some open pit included with underground.

Iron ore mined in the United States, 1930 and 1931, by States and counties

[Exclusive of ore containing 5 per cent or more of manganese]

State and county	1930		1931	
	Active mines	Gross tons	Active mines	Gross tons
Alabama:				
Blount	4	177,554	2	54,692
Cherokee	2	5,465	1	35,993
Coosa	1		------	----------
Franklin	2	165,090	1	83,837
Jefferson	5	5,151,089	5	3,369,481
Shelby	1	50,000	1	24,197
Talladega	5	16,239	1	391
Tuscaloosa	3	173,041	3	46,553
	23	5,738,478	14	3,615,144
Arizona: Yuma	1	923	------	----------
Colorado: Saguache	1	32,247	1	26,202
Georgia:				
Bartow	1	13,934	------	----------
Floyd	------	----------	1	6,874
Polk	4	38,287	2	13,871
	5	52,221	3	20,745

Iron ore mined in the United States, 1930 and 1931, by States and counties—Contd

State and county	1930		1931	
	Active mines	Gross tons	Active mines	Gross tons
Michigan:				
Baraga	1	89,342	1	88,967
Dickinson	5	1,155,994	5	676,624
Gogebic	17	4,760,565	15	2,818,428
Iron	21	3,207,902	20	1,406,533
Marquette	16	4,330,474	14	2,562,029
	60	13,544,277	55	7,552,581
Minnesota:				
Crow Wing	9	1,221,332	8	665,012
Itasca	27	7,510,593	22	4,156,637
St. Louis	48	25,785,823	37	12,623,354
	84	34,517,748	67	17,445,003
Missouri:				
Butler			[1] 1	[1] 4,914
Crawford	1	14,737	3	15,994
Dent	1		[1] 1	[1] 3,355
Texas	1		1	266
Washington	1		(2)	(2)
Franklin	1	21,000	[1] 2	[1] 23,633
Madison			[1] 1	[1] 6,744
Phelps			2	4,997
Pulaski			1	2,740
St. Francois	1	97,012	[1] 2	[1] 2,548
Shannon			[1] 2	[1] 2,187
Other			(3)	[3] 44,994
	6	132,749	[4] 16	112,372
New Jersey:				
Morris	4	323,428	3	232,071
Passaic	1		1	
Warren	1	71,211	1	61,697
	6	394,639	5	293,768
New Mexico: Grant	2	173,432	10	168,075
New York:				
Clinton	1	193,232	1	44,904
Essex	1	634,871	1	205,376
Oneida	1	61,302	1	24,795
Orange	1		1	
Wayne	1		1	
	5	889,405	5	275,075
North Carolina: Ashe	1	100		
Pennsylvania:				
Carbon	1	1,003	1	818
Lebanon	1	963,635	1	367,299
	2	964,638	2	368,117
Tennessee:				
Hamilton	1	326		
Hickman	1	23,277		
Lawrence	1	4,107	1	8,717
	3	27,710	1	8,717
Utah:				
Box Elder	1	200	1	400
Iron	1	277,774	1	183,668
Utah	1	1,144		
	3	279,118	2	184,068
Virginia: Wythe	1	19,596		
Washington: Stevens			1	1,032
Wisconsin:				
Dodge	1	733	1	31
Florence	1	67,181		
Iron	2	1,253,446	2	879,801
	4	1,321,360	3	879,832
Wyoming: Platte	1	320,023	1	180,771
Total for United States	208	58,408,664	[4] 186	31,131,502

[1] Excludes the output of small pits included under "Other."

[2] Included under "Other."

[3] Includes the output from 212 properties at each of which one or more small pits were worked, as follows: Bollinger County, 1 property, 244 tons; Butler County, 31 properties, 2,864 tons; Carter County, 16 properties, 3,562 tons; Dent County, 1 property, 44 tons; Franklin County, 1 property, 34 tons; Gasconade County, 1 property, 30 tons; Howell County, 15 properties, 2,480 tons; Iron County, 1 property, 352 tons; Madison County, 1 property, 195 tons; Oregon County, 3 properties, 195 tons; Osage County, 5 properties, 1,513 tons; Reynolds County, 3 properties, 330 tons; Ripley County, 23 properties, 1,058 tons; St. Francois County, 1 property, 210 tons; Shannon County, 3 properties, 551 tons; Washington County, 1 property, 70 tons; and Wayne County, 105 properties, 31,262 tons.

[4] In addition, an undetermined number of small pits were worked in 1931 at 212 properties in Missouri. The output from these pits is included in the figures given.

Iron ore mined in the United States, by mining districts and varieties, in 1931, in gross tons

[Exclusive of ore containing 5 per cent or more of manganese]

District	Hematite	Brown ore	Magnetite	Carbonate	Total
Lake Superior[1]	25, 877, 385				25, 877, 385
Birmingham	3, 369, 481	125, 442			3, 494, 923
Chattanooga		57, 129			57, 129
Adirondack			[2] 254, 308		[2] 254, 308
Northern New Jersey and southeastern New York			314, 535		314, 535
Other districts	[2] 418, 609	177, 389	536, 406	818	[2] 1, 133, 222
Total, 1931	[2] 29, 665, 475	359, 960	[2] 1, 105, 249	818	31, 131, 502
Total, 1930	[3] [4] 55, 265, 954	[3] 720, 496	[4] 2, 421, 211	1, 003	58, 408, 664

[1] Includes only those mines in Wisconsin that are in the true Lake Superior district.
[2] Some hematite from "Other districts" included with magnetite from Adirondack district.
[3] Some hematite included with brown ore.
[4] Some hematite included with magnetite.

The Lake Superior district, which comprises Minnesota, Michigan, and northern Wisconsin, mined 83.1 per cent of the total iron ore produced in 1931, and the Birmingham district mined 11.2 per cent.

Iron ore mined in the United States, 1927–1931, by States, in gross tons

[Exclusive of ore containing 5 per cent or more of manganese]

Year	Alabama	Arizona	California	Colorado	Georgia	Michigan	Minnesota	Missouri	Montana	New Jersey	New Mexico
1927	6, 445, 464			32, 206	50, 312	15, 075, 079	35, 461, 138	78, 605	2, 837	220, 660	214, 747
1928	6, 307, 844			52, 713	73, 052	13, 676, 984	37, 564, 005	94, 899	1, 640	250, 332	184, 623
1929	6, 453, 075		303	50, 754	59, 316	15, 456, 397	45, 760, 858	168, 934		281, 327	171, 585
1930	5, 738, 478	923		32, 247	52, 221	13, 544, 277	34, 517, 748	132, 749		394, 639	173, 432
1931	3, 615, 144			26, 202	20, 745	7, 552, 581	17, 445. 003	112, 372		293, 768	168, 075

Year	New York	North Carolina	Pennsylvania	Tennessee	Utah	Virginia	Washington	Wisconsin	Wyoming	Total
1927	853, 159	32, 528	1, 170, 435	121, 914	222, 879	64, 592	550	1, 091, 118	602, 877	61, 741, 100
1928	712, 757		1, 023, 870	128, 928	320, 655	27, 902	1, 012	1, 284, 592	491, 280	62, 197, 088
1929	822, 261	30, 675	1, 092, 013	102, 171	324, 985		5, 018	1, 608, 571	639, 477	73, 027, 720
1930	889, 405	100	964, 638	27, 710	279, 118	19, 596		1, 321, 360	320, 023	58, 408, 664
1931	275, 075		368, 117	8, 717	184, 068		1, 032	879, 832	180, 771	31, 131, 502

No iron ore was reported as sold for use in fluxing other metallic ores at smelters in the Western States in 1930 or 1931, and none was sold for purifying gas in 1931.

Iron ore shipped from mines in the United States, 1930 and 1931, by States

[Exclusive of ore containing 5 per cent or more of manganese and ore sold for paint]

State	1930		1931	
	Gross tons	Value	Gross tons	Value
Alabama	5,637,678	$11,015,336	3,629,997	$6,155,995
Arizona	923	(1)		
Colorado	32,247	(1)	26,202	(1)
Georgia	52,221	147,964	20,745	51,513
Michigan	11,154,773	31,515,996	5,555,376	15,986,273
Minnesota	34,165,777	90,835,451	17,063,591	46,020,269
Missouri	132,749	508,354	112,055	337,144
New Jersey	391,528	1,632,827	239,722	984,021
New Mexico	173,432	(1)	168,075	(1)
New York	755,074	3,663,155	259,184	1,067,489
Pennsylvania	894,039	1,850,661	436,920	913,163
Tennessee	27,384	76,089	8,717	36,156
Utah	278,918	(1)	183,668	(1)
Virginia	36,178	65,528		
Washington			1,032	(1)
Wisconsin	1,148,277	3,179,175	629,977	1,658,670
Wyoming	320,023	(1)	180,771	(1)
Undistributed		[2] 1,128,523		[2] 913,217
	55,201,221	145,619,059	28,516,032	74,123,910

[1] Included under "Undistributed."

[2] This figure includes value for States entered as " (1) " above.

PRINCIPAL IRON-ORE MINES

In 1931, 186 iron-ore mines (and an undetermined number of small pits in Missouri) were active compared with 208 mines in 1930 and 211 in 1929; 79 mines produced more than 100,000 gross tons each compared with 130 in both 1930 and 1929. Of these 79 mines 4 (3 in Minnesota and 1 in Alabama) produced more than 1,000,000 tons each compared with 12 (10 in Minnesota, 1 in Alabama, and 1 in Wisconsin) in 1930 and 14 (9 in Minnesota, 2 in Alabama, 1 in Wisconsin, 1 in Pennsylvania, and 1 in Michigan) in 1929. The operators of all of these large mines have permitted publication of figures on output; these data are given in the following table. The predominance of hematite as an iron ore is clearly shown by the fact that of these 79 large mines 76 produced hematite and 3 produced magnetite. The importance of large mining units is shown in the production of 89 per cent of the output of the country by the 79 mines which yielded more than 100,000 tons each.

Iron-ore mines of the United States (arranged in order of rank) that produced more than 100,000 gross tons each in 1931

[All mines produced hematite except Cornwall, Witherbee, Sherman & Co. group, and Union Hill-Republic mines which produced magnetite]

Name of mine	State	Nearest town	Gross tons
Red Mountain group	Alabama	Bessemer	1,762,749
Sellers	Minnesota	Hibbing	1,489,795
Hartley-Burt	do	Chisholm	1,312,914
Hull-Rust	do	Hibbing	1,144,430
Minnewas	do	Virginia	923,642
Leonidas	do	Eveleth	912,088
Adams-Spruce group	do	do	828,589
Mahoning	do	Hibbing	808,213
Woodward Nos. 1 and 3	Alabama	Bessemer	795,583
Montreal	Wisconsin	Montreal	753,992

Iron-ore mines of the United States (arranged in order of rank) that produced more than 100,000 gross tons each in 1931—Continued

Name of mine	State	Nearest town	Gross tons
Pioneer	Minnesota	Ely	654, 805
Norrie-Aurora	Michigan	Ironwood	591, 772
Missabe Mountain	Minnesota	Virginia	555, 944
Morrison	do	Coleraine	549, 017
Mesabi Chief	do	Nashwauk	456, 894
La Rue	do	do	448, 374
Hill Annex	do	Calumet	425, 276
Godfrey	do	Chisholm	385, 289
Raimund Nos. 1 and 2	Alabama	Bessemer	377, 186
Bennett	Minnesota	Keewatin	373, 303
Cornwall	Pennsylvania	Miners Village	367, 299
Sloss Nos. 1 and 2	Alabama	Bessemer	361, 286
Morris-Lloyd	Michigan	Ishpeming	349, 158
Susquehanna	Minnesota	Hibbing	345, 982
Negaunee	Michigan	Negaunee	338, 696
Arcturus	Minnesota	Marble	310, 111
Newport	Michigan	Ironwood	307, 193
Maas	do	Negaunee	305, 604
Plymouth	do	Wakefield	303, 686
Asteroid-Eureka	do	Ramsay	291, 372
Cliffs Shaft	do	Ishpeming	291, 057
Ironton	do	Bessemer	284, 500
Fayal	Minnesota	Eveleth	262, 903
South Agnew	do	Hibbing	260, 850
Sunday Lake	Michigan	Wakefield	254, 223
Athens	do	Negaunee	251, 347
Scranton	Minnesota	Hibbing	243, 115
Wakefield	Michigan	Wakefield	242, 682
Holman-Brown	Minnesota	Taconite	239, 998
Sibley	do	Ely	239, 423
Chapin	Michigan	Iron Mountain	234, 178
Blueberry	do	Ishpeming	229, 667
Morris	Minnesota	Hibbing	226, 216
Armour No. 2 (including Cuyuna-Duluth)	do	Crosby	225, 180
Witherbee, Sherman & Co. group	New York	Mineville	205, 376
Penn group	Michigan	Vulcan	204, 979
Hill-Trumbull	Minnesota	Marble	202, 479
Albany	do	Hibbing	202, 243
Dunwoody	do	Chisholm	198, 960
Wellington	do	do	196, 740
Zenith	do	Ely	191, 665
Puritan	Michigan	Ironwood	186, 982
Loretto	do	Loretto	186, 340
Desert Mound	Utah	Iron Springs	183, 668
Sunrise	Wyoming	Sunrise	180, 771
Burt-Pool-Day	Minnesota	Hibbing	168, 799
Harold	do	Stuntz	159, 080
Rogers	Michigan	Iron River	158, 529
Mace No. 2	Minnesota	Nashwauk	154, 983
Isabella	Michigan	Palmer	154, 910
Lake Superior-Holmes	do	Ishpeming	153, 573
Armour No. 1	Minnesota	Crosby	151, 616
Margaret	do	Buhl	151, 020
North Harrison	do	Cooley	147, 670
Alexandria	do	Hibbing	140, 726
Tilden	Michigan	Ishpeming	137, 010
Hiawatha	do	Iron River	132, 550
Cary	Wisconsin	Hurley	125, 809
Hawkins	Minnesota	Nashwauk	122, 210
Bates	Michigan	Iron River	120, 779
Riverton group	do	do	120, 068
Sargent	Minnesota	Keewatin	118, 929
Warner	Michigan	Amasa	118, 697
Patrick (including Ann)	Minnesota	Cooley	115, 246
Richmond	Michigan	Palmer	107, 958
Croft	Minnesota	Crosby	105, 525
Halobe	do	Cooley	103, 802
Caspian	Michigan	Iron River	102, 802
Union Hill (including Republic)	New Mexico	Fierro	100, 380
Total (79 mines)			27, 628, 455
Output of 29 mines producing between 50,000 and 100,000 tons each			2, 188, 038
Output of 78 mines [1] producing less than 50,000 tons each			1, 315, 009
Grand total of United States (186 mines [1])			31, 131, 502

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[1] In addition, an undetermined number of small pits were worked at 212 properties in Missouri. The output from these pits is included in the figures given.

STOCKS OF ORE AT MINES

According to the reports of producers the total quantity of iron ore in stock at the mines at the end of 1931 was 13,063,708 gross tons compared with 10,383,152 tons at the end of 1930, an increase of 26 per cent. As the quantity of ore in stock piles is of necessity partly estimated, resulting variations in the mine reports from year to year prevent an absolute balance between the quantity mined and the quantity shipped and the stocks on hand. The reported stocks at the end of 1931 were about 3,800,000 tons above the average for the 5-year period 1926 to 1930.

Stocks of iron ore at mines, December 31, 1930 and 1931, by States, in gross tons

State	1930	1931	State	1930	1931
Alabama	909,498	894,645	New York	160,430	178,899
Iowa	12,165	12,165	North Carolina	200	200
Michigan	6,654,663	8,669,145	Pennsylvania	103,183	33,254
Minnesota	2,171,194	2,600,852	Virginia	3,473	3,473
Missouri		317	Wisconsin	303,183	551,649
New Jersey	65,163	119,109			
				10,383,152	13,063,708

VALUE OF ORE PER TON

The table that follows gives the average value at the mines of the different classes of iron ore in 1930 and 1931 for each of the producing States or groups of States, except where there were less than three shippers of a certain variety of ore in a State and permission was not given to publish the value. These figures are taken directly from statements of producers and probably represent the commercial selling prices only approximately, as not all of the reports are comparable. Some of them evidently include mining costs only; others contain, in addition, the cost of selling and insuring the ore; others include an allowance for a sinking fund; and still others include only the costs charged against the blast furnaces. None of the reports, however, is supposed to include freight charges.

Average value per gross ton of iron ore at mines in the United States, 1930 and 1931

[Exclusive of ore containing 5 per cent or more of manganese and of ore sold for paint]

State	Hematite		Brown ore		Magnetite	
	1930	1931	1930	1931	1930	1931
Alabama	$1.88	$1.65	$2.59	$2.38		
Georgia			2.83	2.48		
Michigan	2.83	2.88				
Minnesota	2.66	2.70				
Missouri	3.83	2.92	(1)	3.09		
New Jersey			(1)		$4.17	$4.10
New York					4.85	4.12
Pennsylvania					2.07	2.09
Tennessee			2.78	4.15		
Virginia			1.81			
Wisconsin	2.77	2.63				
Other States [2]	1.23	1.22	1.41	1.35	1.97	2.55
	2.61	2.58	2.53	2.47	3.38	3.07

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[1] Less than three producers; permission to publish not given, therefore value may not be shown.
[2] 1930: Arizona, Colorado, New Mexico, Utah, and Wyoming; 1931: Colorado, New Mexico, Utah, Washington, and Wyoming.

IRON ORE CONSUMED

The furnaces in Alabama in making 1 ton of pig iron consumed in 1931 an average of 2.378 tons of ore, the highest average for any State. The greater part of the iron ore used in Alabama furnaces in 1931 was hematite from mines in Jefferson County, Ala.; small quantities of imported ore and of iron sinter from Tennessee were also used. The brown ore used was chiefly from mines in the Birmingham and Russellville districts, Alabama, and the Cedartown district, Georgia; the manganiferous iron ore was chiefly from mines in Alabama, Arkansas, and Georgia.

In 1931 the furnaces in Maryland used chiefly foreign ores obtained from Australia, Chile, Cuba, Morocco, and Russia, although some domestic ore was also used. The Maryland furnaces consumed an average of only 1.212 tons of ore in making 1 ton of pig iron in 1931; however, they used proportionately more cinder, scale, and scrap than the furnaces in any other State.

The blast furnaces in Indiana, Kentucky, Michigan, Minnesota, Ohio, and West Virginia used Lake Superior iron ore and manganiferous iron ore exclusively in 1931. The consumption of ores per ton of iron made in this group of States ranged from 1.273 tons in Kentucky to 2.044 tons in Minnesota.

The furnaces in the Chicago district, including Joliet, Ill., used iron ore and manganiferous iron ore from mines in the Lake Superior district; those at Granite City, Ill., used ore chiefly from mines in the Lake Superior district, but also ore from various properties in Missouri. An average of 1.722 tons of ore was used to make 1 ton of pig iron in Illinois in 1931.

In New York the furnaces in the Buffalo district used ores from the Lake Superior district; the furnaces at Port Henry used magnetite from the New Bed, Old Bed, and Harmony mines at Mineville, N. Y., and a small quantity of manganese cinder from Canada; and the furnace at Standish used magnetite from the Chateaugay mine at Lyon Mountain, N. Y., and a small quantity of ferruginous manganese ore from Canada. In making 1 ton of pig iron the furnaces in New York used an average of 1.681 tons of ore in 1931.

The furnaces in western Pennsylvania used ore from the Lake Superior district. Those in the eastern part of the State used, in addition to some Lake ores, magnetite from the Cornwall mine in Pennsylvania; magnetites from the Cannon and Peters, Mt. Hope, Washington, Scrub Oaks, and Richard mines in New Jersey; magnetites from the New Bed, Old Bed, Harmony, Chateaugay, and Forest of Dean mines in New York; and considerable quantities of ores from Africa, Australia, and Chile. An average of 1.585 tons of ore was used in Pennsylvania in 1931 to make 1 ton of pig iron.

The blast furnaces at Pueblo, Colo., used brown ore from the Orient mine in Colorado; hematite from the Sunrise mine in Wyoming; magnetite chiefly from the Union Hill, Jim Fair, Snowflake, and Cupola mines in New Mexico; manganiferous iron ores from Leadville, Colo., and Silver City, N. Mex.; and rhodochrosite from the Emma mine in Montana.

The blast furnace at Provo, Utah, used iron ore from the Desert Mound mine in the Iron Springs district, Utah. The manganiferous iron ore used was obtained from California, Idaho, Montana, and Utah.

The two tables following show the consumption of iron ore and other metallic materials, the production of pig iron (as reported to the Bureau of Mines), and the average quantity of materials used per ton of pig iron made.

Iron ore and other metallic materials consumed and pig iron produced in 1931, by States, in gross tons

State	Metalliferous materials consumed				Pig iron produced, exclusive of ferroalloys	Materials consumed per ton of iron made		
	Iron and manganiferous iron ores		Cinder, scale, and scrap	Total		Ores	Cinder, scale, and scrap	Total
	Domestic	Foreign						
Alabama	3,880,895	20,415	177,769	4,079,079	1,640,851	2.378	0.108	2.486
Illinois	3,382,905	----------	232,693	3,615,598	1,965,469	1.722	.118	1.840
Indiana	3,016,748	----------	376,384	3,393,132	1,790,489	1.685	.210	1.895
Kentucky	166,766	----------	46,789	213,555	130,990	1.273	.357	1.630
Maryland	34,511	785,231	328,927	1,148,669	676,536	1.212	.486	1.698
Michigan	939,234	----------	94,357	1,033,591	537,350	1.748	.175	1.923
Minnesota	3,411	----------	25	3,436	1,669	2.044	.015	2.059
New York	1,778,936	4,473	140,688	1,924,097	1,060,935	1.681	.133	1.814
Ohio	6,751,214	----------	829,356	7,580,570	4,117,384	1.640	.201	1.841
Pennsylvania	7,669,160	315,488	1,080,488	9,065,136	5,036,305	1.585	.215	1.800
West Virginia	1,029,088	----------	33,495	1,062,583	605,634	1.699	.055	1.754
Undistributed [1]	633,785	105,980	17,049	756,814	389,001	1.902	.044	1.946
	29,286,653	1,231,587	3,358,020	33,876,260	17,952,613	1.700	.187	1,887

[1] Includes Colorado, Iowa, Massachusetts, Tennessee, and Utah.

Iron ore and other metallic materials consumed and pig iron produced in the United States, 1927–1931, in gross tons

Year	Metalliferous materials consumed				Pig iron produced, exclusive of ferroalloys	Materials consumed per ton of iron made			
	Iron and manganiferous iron ores		Cinder, scale, and scrap	Total		Ores		Cinder, scale, and scrap	Total
	Domestic	Foreign				Domestic	Foreign		
1927	61,718,383	2,540,558	5,602,006	69,860,947	35,875,129	1.720	0.071	0.156	1.947
1928	63,795,555	2,625,620	6,026,785	72,447,960	37,410,897	1.706	.070	.161	1.937
1929	72,330,926	2,887,814	6,817,314	82,036,054	41,761,488	1.732	.069	.163	1.964
1930	53,084,961	2,190,783	4,918,940	60,194,684	31,036,866	1.710	.071	.158	1.939
1931	29,286,653	1,231,587	3,358,020	33,876,260	17,952,613	1.631	.069	.187	1.887

Foreign iron and manganiferous iron ores consumed in the manufacture of pig iron in the United States, 1930 and 1931, by sources of ore, in gross tons

Source of ore	1930	1931	Source of ore	1930	1931
Africa	171,681	89,496	Newfoundland	65,854	37,037
Asia	979	276	Russia	34,445	216,825
Australia	43,632	66,718	Spain	45,986	13,044
Brazil	1,100	----------	Sweden	95,950	----------
Canada	919	4,473	Undistributed	24,273	17,977
Chile	1,510,649	680,042			
Cuba	189,307	105,699		2,190,783	1,231,587
Greece	6,008	----------			

LAKE SUPERIOR DISTRICT

PRODUCTION

The total quantity of iron ore mined in the Lake Superior district, not including the Iron Ridge area in Wisconsin, amounted to 25,877,385 gross tons in 1931, a decrease of 48 per cent compared with 1930. The output of the several ranges is shown in the following table. After 1905 the figures do not include manganiferous iron ore containing 5 per cent or more of manganese; 246,136 gross tons of such ore were mined in 1931 compared with 698,244 tons in 1930. The Mesabi range produced 60 per cent of the iron-ore output of the Lake Superior district and 50 per cent of the total output of the United States in 1931. The proportion contributed by this range has been remarkably uniform since 1915; for the Lake Superior district the proportion from 1915 to 1930 ranged from 63 to 71 per cent and averaged 66 per cent, and for the United States it ranged from 53 to 60 per cent and averaged 56 per cent. Thus, the proportion contributed by the Mesabi range in 1931 was about 5.6 points below the average for the 16-year period from 1915 to 1930.

Iron ore mined in the Lake Superior district, 1854–1931, in gross tons

[Exclusive after 1905 of ore containing 5 per cent or more of manganese]

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1854–1929	170, 876, 884	168, 156, 055	180, 096, 702	56, 767, 675	858, 727, 702	21, 060, 626	1, 455, 685, 644
1930	4, 419, 816	4, 431, 077	6, 014, 011	1, 996, 516	31, 299, 900	1, 221, 332	49, 382, 652
1931	2, 650, 996	2, 083, 157	3, 698, 229	1, 181, 224	15, 598, 767	665, 012	25, 877, 385
	177, 947, 696	174, 670, 289	189, 808, 942	59, 945, 415	905, 626, 369	22, 946, 970	1, 530, 945, 681

SHIPMENTS AND RECEIPTS

According to the Lake Superior Iron Ore Association 23,496,228 gross tons of iron ore and manganiferous iron ore were shipped in 1931 from the Lake Superior district compared with 47,187,661 tons in 1930. The shipments as reported to the Bureau of Mines amounted to 23,249,212 gross tons of iron ore and 246,136 tons of manganiferous iron ore containing 5 per cent or more of manganese, a total of 23,495,348 tons, in 1931 compared with 46,471,847 tons of iron ore and 698,244 tons of manganiferous iron ore, a total of 47,170,091 tons, in 1930.

According to the Lake Superior Iron Ore Association the iron ore received at Lake Erie ports amounted to 14,756,430 gross tons and at other than Lake Erie ports to 8,476,707 gross tons, a total of 23,233,137 tons, in 1931 compared with 31,779,844 tons at Lake Erie ports and 14,337,329 tons at other than Lake Erie ports, a total of 46,117,173 tons, in 1930.

STOCKS OF ORE AT LAKE ERIE PORTS

Stocks of iron ore at lower Lake ports at the end of the shipping season are important because of their bearing on the manufacture of pig iron during the following winter and spring. According to the Lake Superior Iron Ore Association, at the close of navigation in

1931, 6,048,327 gross tons of iron ore were in stock at Lake Erie ports compared with 6,466,326 tons on the corresponding date in 1930. At the opening of navigation in May, 1932, 5,517,051 tons of ore were in stock at these ports, indicating a withdrawal of 531,276 tons during the winter of 1931–32. The average quantity withdrawn each winter during the preceding five years was about 2,144,000 tons.

PRICES OF LAKE SUPERIOR ORE

The price of iron ore per unit of iron in the natural state for the four standard grades of Lake Superior ore for the last 18 years is shown in Steel.[5] The base of Bessemer ore, old-range and Mesabi, for 1925 to 1931 is a metallic iron content of 51.5 per cent (natural), instead of 55 per cent as for 1924 and many earlier years. The base of non-Bessemer ore, old-range and Mesabi, remains as heretofore at 51.5 per cent (natural). The unit prices established April 15, 1931, are the same as those for 1929 and 1930, as follows: Old-range Bessemer, 9.32 cents; Mesabi Bessemer, 9.029 cents; old-range non-Bessemer, 9.029 cents; and Mesabi non-Bessemer, 8.738 cents. The prices per ton that correspond to these prices are, respectively, $4.80, $4.65, $4.65, and $4.50. The lowest prices ever quoted for these ores were $2.60 for old-range Bessemer in 1897, $2.15 for Mesabi Bessemer in 1895, $1.85 for old-range non-Bessemer in 1898, and $1.75 for Mesabi non-Bessemer in 1898.

IRON-ORE RESERVES

Estimates of ore reserves for Minnesota, furnished by the Minnesota Tax Commission, and for Michigan, furnished by the Michigan Board of State Tax Commissioners, cover developed and prospective ore in the ground and ore in stock piles. These estimates show an increase from the previous year of about 9,095,000 gross tons in Minnesota but a decrease of about 3,918,000 tons in Michigan.

Iron-ore reserves in Minnesota May 1, 1927–1931, in gross tons

Range	1927	1928	1929	1930	1931
Mesabi	1, 201, 054, 119	1, 190, 480, 901	1, 178, 855, 601	1, 154, 434, 031	1, 162, 776, 979
Vermilion	12, 126, 490	14, 483, 285	14, 939, 704	14, 250, 540	14, 789, 137
Cuyuna	49, 652, 592	53, 268, 438	48, 264, 579	66, 542, 939	66, 756, 610
	1, 262, 833, 201	1, 258, 232, 624	1, 242, 059, 884	1, 235, 227, 510	1, 244, 322, 726

Iron-ore reserves in Michigan January 1, 1928–1932, in gross tons

Range	1928	1929	1930	1931	1932
Gogebic	48, 681, 075	48, 587, 126	51, 347, 176	51, 143, 511	50, 793, 057
Marquette	60, 219, 781	57, 920, 862	55, 655, 383	57, 665, 510	56, 335, 788
Menominee (including Iron River and Crystal Falls districts)	64, 752, 677	62, 922, 419	61, 347, 264	62, 178, 324	59, 940, 058
	173, 653, 533	169, 430, 407	168, 349, 823	170, 987, 345	167, 068, 903

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[5] Steel: Vol. 88, Apr. 23, 1931, p. 29.

IRON-ORE MINING, BY STATES

LAKE SUPERIOR DISTRICT

Michigan.—Mining activity on the Michigan ranges in 1931 was greatly curtailed, as is shown by a production of 7,552,581 gross tons compared with 13,544,277 tons in 1930.

The ore reserves in Michigan on January 1, 1932, amounted to 167,068,903 gross tons, a decrease from the previous year of 3,918,442 tons.

The Norrie-Aurora mine in Gogebic County had the largest output of any mine in Michigan in 1931—591,772 tons. Of the 55 active mines in Michigan in 1931, 27 yielded more than 100,000 tons each. The average production per mine in Michigan was 137,320 tons in 1931 compared with 225,738 tons in 1930.

A report on the iron-ore mines of Michigan for 1931, published by the geological survey division of the Michigan Department of Conservation,[6] shows that the average number of men employed per day was 6,112, the average number of days worked underground and in open pits 170, the average daily wage $4.963, the average yearly earning $843.71, and the average tons of ore mined per man per day 5.3.

The following table on average per-ton costs of mining ore at underground mines and at siliceous open pits has been condensed from statistics published in much greater detail by the geological survey division.

Average per-ton costs of mining iron ore at underground mines and at siliceous open pits in Michigan in 1931

Item	Underground					Siliceous open pits
	Dickinson	Gogebic	Iron	Marquette	Total	
Cost of mining	$1.9704	$1.6389	$1.5871	$1.6318	$1.6588	$0.4689
Deferred mining costs	.0788	.1712	.0992	.0574	.1073	.0387
Taxes	.3595	.6680	.5370	.4117	.5206	.1146
General overhead	.2261	.2540	.4075	.2779	.2922	.1480
Transportation	1.4581	1.6596	1.4663	1.3985	1.5334	1.4030
Marketing	.0551	.0144	.0844	.0787	.0528	.0971
Royalty	.3374	.3749	.3414	.0963	.2770	.0905
Interest on borrowed money	.0218	.1384	.0538	.0620	.0823	.0102
Total ore cost	4.5072	4.9194	4.5767	4.0143	4.5244	2.3710
Lake Erie value per ton	4.4540	4.8255	4.3952	4.6940	4.6563	2.2604
Gross ore profit[1]	−.0532	−.0939	−.1815	.6797	.1319	−.1106

[1] This figure does not represent true profit, as much ore is sold at a discount.

Minnesota.—Mining activities in Minnesota were drastically reduced in 1931. The production of 17,445,003 gross tons represented a decrease of 49 per cent from 1930.

The reserves of ore in Minnesota on May 1, 1931, amounted to 1,244,322,726 gross tons, an increase of 9,095,216 tons over the previous year.

In 1931 the largest producing mine in Minnesota was the Sellers, an open-pit operation in St. Louis County, which yielded 1,489,795 gross tons. The Hartley-Burt and Hull-Rust mines, also open-pit operations in St. Louis County, yielded 1,312,914 and 1,144,430 tons, respectively, in 1931. The Hull-Rust mine, for many years world famed as the largest producer, has yielded a total of 101,572,406 tons. Of the 67 active mines in Minnesota in 1931, 41 yielded more than 100,000 tons each. The average production per mine in Minnesota was 260,373 tons in 1931 compared with 410,926 tons in 1930.

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[6] Pardee, F. G., and Osgood, W., General Statistics Covering Costs and Production of Michigan Iron Mines: Geol. Survey Div., Michigan Dept. of Conservation (Lansing), 1932.

According to the annual report of the mine inspector of St. Louis County an average of 4,824 men was employed in iron-ore mines in St. Louis County during 1931 and the average daily wage was $5.31 compared with an average of 7,752 men employed and an average daily wage of $5.33 in 1930. In 1931, 6,460,182 cubic yards of overburden were stripped from mines in St. Louis County compared with 8,368,554 cubic yards in 1930.

According to the annual report of the mine inspector of Itasca County an average of 2,940 men was employed in iron-ore mines in Itasca County during 1931 and the average daily wage was $5.26 compared with an average of 4,393 men employed and an average daily wage of $5.38 in 1930. In 1931, 4,476,523 cubic yards of overburden were stripped from mines in Itasca County compared with 8,249,971 cubic yards in 1930.

Wisconsin.—The production of iron ore in Wisconsin in 1931 was 879,832 gross tons, a decrease of 33 per cent from 1930.

The chief producing mine in Wisconsin in 1931, as for many years past, was the Montreal mine in Iron County, which yielded 753,992 gross tons.

Iron-ore analyses.—The iron content of the ore shipped from the Lake Superior district in 1931 averaged 51.53 per cent (natural) compared with 51.33 per cent in 1930 and 51.18 per cent in 1929, showing how closely these ores are graded. The percentages of phosphorus, silica, manganese, and moisture decreased slightly.

The following table, compiled by the Lake Superior Iron Ore Association, summarizes the average analyses of the total tonnages of all grades of ore shipped and shows the remarkable uniformity maintained during the past 5 years.

Average analyses of total tonnages of all grades of iron ore from all ranges of Lake Superior district, 1927–1931

Year	Gross tons	Iron (natural)	Phosphorus	Silica	Manganese	Moisture
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1927	51,730,711	51.19	0.105	8.60	0.84	11.31
1928	54,045,941	51.15	.099	8.43	.85	11.37
1929	65,443,546	51.18	.100	8.48	.80	11.24
1930	46,698,554	51.33	.095	8.70	.82	10.92
1931	23,281,333	51.53	.087	8.60	.80	10.84

During this 5-year period the iron content ranged from 51.15 to 51.53 per cent, the phosphorus from 0.087 to 0.105 per cent, the silica from 8.43 to 8.7 per cent, the manganese from 0.80 to 0.85 per cent, and the moisture from 10.84 to 11.37 per cent. This uniformity does not, of course, mean that the average grade of the available Lake Superior iron ore is not declining. The grade of shipments has been maintained by methods of beneficiation and by mixing ores from different deposits.

SOUTHEASTERN STATES

Alabama.—The production of iron ore in Alabama in 1931 amounted to 3,615,144 gross tons, a decrease of 33 per cent from 1930.

The ore produced in Blount County in 1931 was brown ore, all of which was washed, screened, picked, and jigged; the iron content of the concentrates averaged 51 per cent (dried), the manganese 0.4 per cent, and the phosphorus 0.35 per cent. The brown-ore concentrates from the Russellville district in Franklin County averaged 50.18 per cent iron (dried), 0.52 per cent manganese, and 0.59 per cent phosphorus. The brown-ore concentrates from Tuscaloosa County in 1931 averaged 47.69 per cent iron (dried), 1.19 per cent manganese, and 0.3 per cent phosphorus. The brown-ore concentrates produced in Shelby County averaged 49 per cent iron (dried), 0.75 per cent manganese, and 0.2 per cent phosphorus. The brown ore produced in Cherokee County averaged 49.4 per cent iron (dried), 1.52 per cent manganese, and 0.62 per cent phosphorus.

Most of the ore mined in Alabama is hematite, much of which contains enough lime to make it self-fluxing or nearly so. Hematite was produced only in Jefferson County in 1931; the iron content of that shipped in 1931 ranged from 33.6 to 39.07 per cent (natural) and averaged 36.63 per cent; the manganese content averaged 0.14 per cent and the phosphorus content 0.31 per cent.

In 1931 the largest producing mine in the United States was the Red Mountain group, in Jefferson County, which yielded 1,762,749 gross tons.

Georgia.—The production of iron ore in Georgia in 1931 was 20,745 gross tons, a decrease of 60 per cent from 1930.

All the ore from Georgia in 1931 was brown ore; the iron content of the concentrates from the Cedartown area in Polk County averaged 52 per cent iron (dried) and 0.87 per cent manganese; the ore from Floyd County averaged 49.4 per cent iron (dried), 1.52 per cent manganese, and 0.62 per cent phosphorus.

Tennessee.—The production of iron ore in Tennessee was 8,717 gross tons compared with 27,710 tons in 1930, a decrease of 69 per cent. The Van Leer mine in Lawrence County was the only active iron-ore mine in Tennessee in 1931.

A considerable quantity of iron sinter recovered from copper sulphide ore mined in Polk County was shipped in 1931; this sinter averaged 64.64 per cent iron, 0.14 per cent manganese, and 0.006 per cent phosphorus. These shipments are not included in the statistics of iron ore.

MISSOURI

The production of iron ore in Missouri in 1931 was 112,372 gross tons, a decrease of 15 per cent from 1930. The output in 1931 consisted of 54,139 tons of hematite and 58,233 tons of brown ore. The iron content (dried) of the ore shipped in 1931 averaged 53.42 per cent. Most of the ore from Missouri mines in 1931 was shipped to the blast furnaces at Granite City, Ill. The Missouri production, however, was only about one-third of the ore requirements of these furnaces, the larger part of the ore they consumed being obtained from the Lake Superior district. The Iron Mountain mine in St. Francois County, which produced 97,012 tons of ore in 1930, was inactive during 1931, although a small quantity of high-grade surface ore was recovered and shipped. The decrease in production at this mine, however, was somewhat offset by new mining activities in southern and southeastern Missouri. That the mining of iron ore in Missouri in 1931 was widespread is shown by the fact that 16 mines and an undetermined number of small pits at 212 properties were operated in 21 counties.

NORTHEASTERN STATES

New Jersey.—The production of iron ore in New Jersey in 1931 was 293,768 gross tons, a decrease of 26 per cent from 1930. The production in 1931 was from the Mount Hope, Scrub Oaks, and Richard mines in Morris County, the Washington mine in Warren County, and the Cannon and Peters mines in Passaic County. All the ore produced in New Jersey in 1931 was concentrated; the iron content of the concentrates shipped ranged from 59.42 to 65.73 per cent and averaged 62.05 per cent. The Mount Hope mine was again the largest producer of iron ore in New Jersey, with an output of 96,147 tons of concentrates.

New York.—The production of iron ore in New York in 1931 was 275,075 gross tons, a decrease of 69 per cent from 1930. Operations at the Harmony and Old Bed mines at Mineville, Essex County, were greatly curtailed in 1931, the Harmony mine being operated part time only three months and the Old Bed being worked at a reduced rate most of the year. The product shipped from these mines in 1931 consisted of 143,005 tons of sinter averaging 65.88 per cent of iron, 0.03 per cent of manganese, and 0.13 per cent of phosphorus; 23,064 tons of concentrates averaging 68 per cent of iron, 0.03 per cent of manganese, and 0.21 per cent of phosphorus; and 27,746 tons of lump ore averaging 63.15 per cent of iron, 0.08 per cent of manganese, and 0.83 per cent of phosphorus. The Chateaugay mine in Clinton County was operated only about three months; all the ore from this mine is sintered, and the sinter shipped in 1931 averaged 65.5 per cent of iron, 0.09 per cent of manganese, and 0.005 per cent of phosphorus. The Forest of Dean mine in Orange County yielded about 63 per cent less magnetite concentrates in 1931 than in 1930; the concentrates shipped in 1931 averaged about 62 per cent of iron. New York is the largest producer of iron ore for use in paint. The ore, known as Clinton hematite, was mined in 1931 in Oneida and Wayne Counties.

Pennsylvania.—Pennsylvania, the most important source of magnetite in the United States, produced 368,117 gross tons of ore in 1931, a decrease of 62 per cent from 1930. The magnetite shipped in 1931 averaged 40.57 per cent of iron (natural). Some carbonate ore for use in paint was mined in Carbon County in 1931.

WESTERN STATES

Colorado.—The production of brown ore in Colorado in 1931 was 26,202 gross tons, a decrease of 19 per cent from 1930. This ore was mined at the Orient mine in Saguache County and averaged (natural) 43.3 per cent of iron, 1.42 per cent of manganese, and 0.026 per cent of phosphorus.

New Mexico.—The production of iron ore, all magnetite, in New Mexico in 1931 was 168,075 gross tons, a decrease of 3 per cent from 1930. The ore mined in 1931 consisted of 126,148 tons from the mines of the Hanover Bessemer Iron & Copper Co., in Grant County, and

41,927 tons from various neighboring properties, also in Grant County. The iron content of the ore shipped ranged from 54.93 to 61.35 per cent (natural) and averaged 56.4 per cent. All the iron ore from these mines was shipped to Pueblo, Colo., a distance of 694 miles.

Utah.—The production of iron ore in Utah in 1931 was 184,068 gross tons, a decrease of 34 per cent from 1930. The ore produced in Utah in 1931 was chiefly hematite from the Desert Mound mine near Iron Springs, Iron County; it averaged 53 per cent of iron (natural). A small quantity of iron ore was produced at the Tecoma mine in Box Elder County.

Washington.—The Big Iron mine in Stevens County was the only active mine in Washington in 1931; the ore is magnetite.

Wyoming.—The production of iron ore in Wyoming in 1931 was 180,771 gross tons, a decrease of 44 per cent from 1930. The output was from the Sunrise mine in Platte County. The ore is hematite; that shipped in 1931 averaged 52.8 per cent of iron (natural), 0.13 per cent of manganese, and 0.067 per cent of phosphorus.

FOREIGN TRADE IN IRON ORE

IMPORTS AND EXPORTS

The iron ore imported into the United States amounted to 1,465,613 gross tons, valued at $3,901,775, in 1931 compared with 2,775,124 tons, valued at $8,113,039, in 1930; these figures represent decreases in 1931 of 47 per cent in quantity and 52 per cent in total value. Chile continued to be the chief source of imports, furnishing 51 per cent of the total. The other main sources of imported ore in 1931 were Africa, Cuba, Norway, Russia, and Sweden; 42 per cent of the total came from these countries. The large increase in imports from Russia and the importation of 73,082 gross tons of iron ore from Norway in 1931 are noteworthy.

Iron ore imported into the United States, 1929–1931, by countries

Country	1929		1930		1931	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Africa:						
Algeria and Tunisia	171,995	$570,852	232,265	$836,333	70,471	$276,752
Morocco	----------	----------	5,170	15,054	15,509	53,643
Mozambique	----------	----------	1	15	----------	----------
Australia	41,798	132,161	219,926	659,236	39,979	147,584
Belgium	----------	----------	----------	----------	115	781
Brazil	46,050	259,367	24,507	93,768	25	416
Canada	3,542	14,502	395	2,767	1,490	4,913
Chile	1,699,066	2,462,738	1,689,071	4,051,301	750,702	1,819,355
Cuba	641,350	2,334,635	190,654	781,301	89,000	212,386
Egypt	77,690	471,077	6,925	44,885	----------	----------
Germany	545	1,656	295	5,748	25	730
Greece	12,750	52,362	----------	----------	----------	----------
India, British	8,000	27,239	7,170	24,425	----------	----------
Kwantung	----------	----------	----------	----------	8	41
Mexico	----------	----------	157	286	1,456	3,150
Netherlands	----------	----------	----------	----------	1	19
Newfoundland and Labrador	76,340	317,294	48,771	202,006	22,920	77,939
Norway	----------	----------	----------	----------	73,082	262,527
Persia	----------	----------	2,500	48,665	----------	----------
Philippine Islands	----------	----------	----------	----------	3	20
Soviet Russia in Europe	----------	----------	63,412	136,228	278,612	571,290
Spain	48,885	262,326	81,012	255,041	38,191	121,179
Sweden	310,406	1,221,508	202,748	952,925	83,554	341,404
United Kingdom	916	17,618	145	3,055	470	7,646
Venezuela	1	19	----------	----------	----------	----------
	3,139,334	8,145,354	2,775,124	8,113,039	1,465,613	3,901,775

Exports of iron ore from the United States amounted to 435,665 gross tons, valued at $1,657,832 ($3.81 a ton), in 1931 compared with 752,267 tons, valued at $2,734,168 ($3.63 a ton), in 1930; these figures represent decreases in 1931 of 42 per cent in quantity and 39 per cent in total value. As usual, practically all the iron ore exported in 1931 went to Canada.

Iron ore exported from the United States, 1930 and 1931, by countries

Country	1930		1931	
	Gross tons	Value	Gross tons	Value
Brazil			9	$54
Canada	752,088	$2,731,636	435,629	1,657,536
Cuba	28	401		
Mexico	7	84	27	242
Panama	51	1,314		
Philippine Islands	89	700		
Poland and Danzig	4	33		
	752,267	2,734,168	435,665	1,657,832

IRON-ORE MINING IN CUBA

Shipments of iron ore from Cuba to the United States amounted to 90,947 gross tons in 1931 compared with 187,264 tons in 1930, a decrease of 51 per cent, and were the smallest since 1885. They consisted of 91.2 per cent of hematite, including a little magnetite, from the Daiquiri and Juragua mines on the southern coast and 8.8 per cent of brown ore from the Mayari mines near the northern coast. In 1931 the hematite (dried at 212° F.) contained 57.66 per cent of iron, whereas the brown ore (nodulized) carried 55.9 per cent. In 1930 the hematite (dried) averaged 57.71 per cent, whereas the brown ore (nodulized) averaged 55.61 per cent.

The total stock of ore (natural and nodulized) reported on hand was 577,899 gross tons at the end of 1931 compared with 484,056 tons at the end of 1930, an increase of 19 per cent.

The following table shows the shipments of iron ore from Cuba since the mines were opened in 1884. The statistics of the shipments of Cuban iron ore are collected by the Bureau of Mines.

Iron ore shipped from mines in the Province of Oriente, Cuba, 1884–1931, in gross tons

Year	Juragua (hematite and magnetite)	Daiquiri (hematite and a little magnetite)	Sigua (hematite)	Mayari (brown ore)	Guamá (hematite)	El Cuero (hematite)	Total
1884–1929	[1] 20,127,655		20,438	3,637,001	41,241	903,103	24,729,438
1930	161,799			25,465			187,264
1931	82,899			8,048			90,947
	20,372,353		20,438	3,670,514	41,241	903,103	25,007,649

[1] Of this quantity, 5,932 tons sent to Pictou, Nova Scotia, and 64,228 tons sent to ports outside of the United States.

WORLD PRODUCTION OF IRON ORE, BY COUNTRIES

The following table shows the production of iron ore by countries from 1927 to 1931, so far as figures are obtainable. Figures for preceding years appear in earlier volumes of Mineral Resources. Complete returns for 1931 are not yet available, but those for 1930 and earlier years are fairly complete. Thus, the figures for 1930 indicate a total world production of about 178,000,000 metric tons, of which the United States furnished about 33 per cent. In 1929 the United States contributed about 37 per cent of the world total, which apparently was 200,000,000 metric tons.

Iron ore produced, 1927–1931, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1927	1928	1929	1930	1931
North America:					
Cuba [1]	421, 505	400, 750	682, 095	190, 270	92, 407
Mexico	64, 000	80, 293	112, 749	(2)	(2)
Newfoundland [3]	1, 356, 851	1, 572, 725	1, 541, 334	1, 196, 856	716, 579
United States	62, 732, 045	63, 195, 351	74, 199, 815	59, 346, 123	31, 631, 163
South America:					
Brazil [4]	30, 000	30, 000	30, 000	30, 000	30, 000
Chile [5]	1, 516, 440	1, 515, 203	1, 812, 343	1, 695, 089	741, 650
Europe:					
Austria	1, 598, 570	1, 928, 182	1, 891, 381	1, 180, 451	511, 945
Belgium	180, 890	164, 420	155, 670	130, 990	(2)
Czechoslovakia	1, 590, 527	1, 779, 176	1, 807, 663	1, 652, 920	1, 235, 078
France	45, 482, 380	49, 191, 300	50, 731, 100	48, 820, 526	38, 784, 209
Germany [6]	6, 315, 186	6, 296, 261	6, 191, 232	5, 658, 574	(2)
Greece	123, 865	166, 868	253, 025	(2)	(2)
Hungary	194, 400	199, 547	251, 711	157, 421	84, 033
Italy	503, 290	625, 488	715, 171	718, 124	560, 853
Luxemburg	7, 266, 249	7, 026, 832	7, 571, 206	6, 649, 372	4, 764, 926
Netherlands	1, 000	1, 100	900	------------	------------
Norway	328, 134	530, 508	746, 112	772, 423	574, 887
Poland	546, 370	736, 755	659, 568	476, 846	284, 653
Portugal	7, 600	14, 000	11, 126	(2)	(2)
Rumania	97, 138	83, 869	90, 014	92, 517	(2)
Russia [7]	4, 791, 530	5, 911, 456	[8] 7, 100, 000	[8] 10, 148, 500	(2)
Spain	4, 960, 394	5, 771, 207	6, 546, 648	5, 517, 211	3, 190, 203
Sweden	9, 660, 977	4, 668, 801	11, 467, 551	11, 236, 428	7, 070, 868
Switzerland [9]	81, 661	65, 702	88, 445	101, 925	34, 239
United Kingdom—					
Great Britain [10]	11, 386, 467	11, 443, 083	13, 427, 043	11, 813, 850	7, 748, 255
Northern Ireland	5, 303	819	700	------------	------------
Yugoslavia	336, 099	439, 481	427, 946	431, 189	133, 410
Asia:					
China	1, 710, 135	[4] 1, 700, 000	[4] 1, 700, 000	[4] 1, 700, 000	(2)
Chosen	483, 996	504, 375	551, 814	532, 497	(2)
India, British	1, 876, 375	2, 088, 991	2, 467, 533	1, 879, 311	(2)
Japan	159, 005	157, 706	178, 000	(2)	(2)
Russia [7]	21, 476	12, 970	(8)	(8)	(2)
Unfederated Malay States—					
Johore	416, 548	654, 981	755, 138	714, 081	496, 723
Trengganu	------------	26, 343	55, 693	76, 187	184, 256

[1] Shipments.
[2] Data not available.
[3] Shipments from Wabana mines.
[4] Approximate production.
[5] Production of Tofo mines.
[6] Exclusive of manganiferous iron ore carrying 12 to 30 per cent of manganese.
[7] Year ended Sept. 30.
[8] Russia in Asia included with Russia in Europe.
[9] Exports.
[10] Exclusive of bog ore, which is used mainly for the purification of gas.

Iron ore produced, 1927–1931, by countries, in metric tons—Continued

Country	1927	1928	1929	1930	1931
Africa:					
Algeria	2,004,189	1,985,626	2,196,182	2,231,868	900,396
Belgian Congo	78,000	51,000	50,000	14,000	19,000
Madagascar	(11)	------------	------------	------------	------------
Morocco—					
French	1,050	------------	------------	(2)	(2)
Spanish [9]	997,111	1,060,709	1,061,424	752,715	500,650
Rhodesia—					
Northern	3,474	4,538	3,613	10	771
Southern	477	3,112	3,406	2,524	535
South-West Africa	21,753	29,929	28,697	39,969	22,214
Tunisia	915,000	909,000	977,000	828,000	446,600
Union of South Africa [1]	77,523	20,898	38,270	51,662	15,447
Oceania:					
Australia—					
New South Wales [12]	182,999	85,558	[13] 6,580	------------	------------
Queensland	515	------------	1,256	2,456	4,629
South Australia	734,020	628,240	861,420	943,293	293,820
New Zealand	6,997	12,929	8,172	(2)	7,031
	171,300,000	173,800,000	199,500,000	178,400,000	(2)

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[1] Shipments.
[2] Data not available.
[9] Exports.
[11] 175 kilograms.
[12] Exclusive of iron oxide used for paint.
[13] Quantity smelted; production not available.

BENEFICIATED IRON ORE

In 1931 the processes reported in use in the United States to improve the grade of the ore at the mines were drying, hand picking, washing, jigging, electromagnetic separation, and sintering. Some operators combined two or more of these processes. At many mines the ore is crushed and screened to improve its structure; ore so improved, however, is not included in the statistics of beneficiated ore. Beneficiation of iron ore was reported at 48 mines in 9 States in 1931 and at 70 mines in 10 States in 1930. Some iron ore is recovered in the form of dust from blast furnaces, but no statistics on it have been gathered; ore so recovered, however, has been included originally in the statistics of shipments from the mines.

Beneficiated ore shipped from mines in the United States in 1931 amounted to 4,676,364 gross tons, valued at $13,042,609, decreases of 48 per cent in quantity and 51 per cent in total value compared with 1930. Such figures as are available for 1931 to show the relation between crude ore treated and beneficiated ore recovered indicate that in washing brown ore the ratios, by weight, of crude ore washed to resultant concentrates ranged from 7:1 to 3:1; in concentrating hematite, from 3.003:1 to 1.227:1; and in concentrating magnetite, from 2.376:1 to 1.085:1. The ratio in concentrating carbonate was 1.585:1.

The quantity of crude ore beneficiated in the Lake Superior district in 1931 amounted to 5,923,349 gross tons and the beneficiated ore recovered to 3,612,244 tons—a loss of 2,311,105 tons and a ratio of 1.64:1. In 1930 the crude Lake ore treated amounted to 11,275,933 tons and the beneficiated ore recovered therefrom to 6,335,659 tons—a loss of 4,940,274 tons and a ratio of 1.78:1.

Beneficiated iron ore shipped from mines in the United States, 1930 and 1931

[Exclusive of ore containing 5 per cent or more of manganese and of ore sold for paint]

State	Variety	1930		1931	
		Gross tons	Value	Gross tons	Value
Alabama	Brown ore	586,878	$1,522,678	209,279	$523,515
Georgia	do	52,221	147,964	13,871	40,023
Minnesota	Hematite	6,316,111	16,735,527	3,574,309	9,187,883
Missouri	Hematite, brown ore	97,212	(1)	4,914	(1)
New Jersey	Magnetite	390,999	1,629,655	239,722	984,021
New Mexico	do	127,205	(1)	91,073	(1)
New York	do	755,074	3,663,155	259,184	1,067,489
Pennsylvania	do	[2] 601,208	[2] 2,104,000	275,295	964,000
Tennessee	Hematite, brown ore	27,384	76,089	8,717	36,156
Virginia	Brown ore	19,596	(1)		
Undistributed			682,437		239,522
		[2] 8,973,888	[2] 26,561,505	4,676,364	13,042,609

[1] Included under "Undistributed."

[2] Revised figures.

The next table gives the shipments of beneficiated iron ore and the percentage of beneficiated ore to the total ore shipped from 1927 to 1931. Corresponding figures from 1914 (the first year for which statistics were gathered) to 1926 are given in the chapter of this series for 1930. Except for a few years the increase in the tonnage of beneficiated ore shipped has been slow but steady. During the 5-year period 1914 to 1918 the shipments of beneficiated ore averaged 10.6 per cent of the total ore; during the next 5-year period (1919 to 1923) they increased to 13.5 per cent; and during the following 5-year period (1924 to 1928) they decreased to 13.2 per cent. In 1929 they decreased further to 12.5 per cent; but in 1930 and 1931 they increased to 16.3 and 16.4 per cent, respectively.

Iron ore shipped from mines in the United States, 1927–1931, in gross tons, and percentage of beneficiated ore to the total shipped

[Exclusive of ore containing 5 per cent or more of manganese and of ore sold for paint]

Year	Beneficiated	Total	Percentage of beneficiated to total	Year	Beneficiated	Total	Percentage of beneficiated to total
1927	8,114,673	61,232,473	13.3	1930	[1] 8,973,888	55,201,221	[1] 16.3
1928	8,621,331	63,432,826	13.6	1931	4,676,364	28,516,032	16.4
1929	9,424,445	75,602,734	12.5				

[1] Revised figures.

Minnesota contributed 65 per cent of the total shipments of beneficiated ore during the period 1914 to 1931. The proportion of beneficiated to total iron ore shipped from Minnesota increased from 9.1 per cent in 1914 to 17 per cent in 1923 and remained practically stationary in 1924 and 1925. The proportion declined sharply to 14 per cent in 1929. In 1930, however, new washing plants to treat ores from the Holman-Brown, Bingham-North Star, Drew, and Malta mines and a new sintering plant to treat ore from the Bruce mine were put in operation; the capacity of the sintering plant at the Evergreen mine was increased 50 per cent; and an additional unit, doubling the capacity, was built at the Patrick mine. These additions resulted in an increase to 18.5 per cent in 1930 in the proportion of beneficiated ore shipped from Minnesota. In 1931 the proportion was further increased to 20.9 per cent.

IRON AND STEEL

The records of the production and sales of iron and steel shown in the following pages are derived in part from data supplied by producers who report direct to the Bureau of Mines and in part from several other authoritative sources, such as the American Iron and Steel Institute, Metal Statistics, Iron Age, and Steel. The statistics on imports and exports are from the Bureau of Foreign and Domestic Commerce.

PIG IRON

SHIPMENTS, VALUE, AND PRODUCTION, BY STATES

The total shipments of pig iron, exclusive of ferro-alloys, reported by manufacturers to the Bureau of Mines amounted to 17,812,579 gross tons, valued at $285,147,156, in 1931, a decrease of 40 per cent in quantity and 44 per cent in total value compared with 1930. The pig iron shipped includes metal produced from foreign as well as from domestic ore. Shipments of pig iron made from imported ore amounted to 740,967 gross tons, valued at $11,660,226, in 1931 compared with 1,216,406 tons, valued at $21,314,142, in 1930. The values given represent the approximate amounts received for the iron f. o. b. furnaces and do not include freight costs, selling commissions, and other items that are figured in some of the market prices of pig iron as published in trade journals.

The total production of pig iron, exclusive of ferro-alloys, reported by manufacturers to the Bureau of Mines was 17,952,613 gross tons in 1931 compared with 31,036,866 tons in 1930, a decrease of 42 per cent. Of the pig iron manufactured in 1931, 737,695 gross tons were made from 1,231,587 gross tons of foreign ore from Africa, Asia (Palestine), Australia, Canada, Chile, Cuba, Newfoundland, Russia, and Spain, indicating an average pig-iron yield of 59.9 per cent from imported ore. Domestic ore and 3,358,020 gross tons of cinder, scale, and scrap, amounting in all to 32,644,673 tons, were reported as used in making 17,214,918 tons of pig iron, indicating an average pig-iron yield of 52.73 per cent from domestic materials.

Pig iron shipped from blast furnaces in the United States, 1930 and 1931, by States

State	1930		1931	
	Gross tons	Value	Gross tons	Value
Alabama	2,294,513	$31,083,905	1,617,331	$20,024,541
Colorado	(1)	(1)	(1)	(1)
Illinois	3,050,743	54,290,144	1,727,834	29,178,510
Indiana	3,195,517	52,869,137	1,721,925	28,458,099
Iowa	----------	----------	(1)	(1)
Kentucky	85,328	(1)	128,194	(1)
Maryland	981,466	(1)	677,076	(1)
Massachusetts	(1)	(1)	(1)	(1)
Michigan	711,224	12,859,820	519,643	8,964,439
Minnesota	266,622	(1)	17,878	(1)
New Jersey	405	(1)	----------	----------
New York	1,638,323	29,160,894	1,014,320	15,568,275
Ohio	6,541,212	111,529,209	4,290,669	69,001,692
Pennsylvania	9,734,591	176,521,843	5,099,016	86,877,965
Tennessee	42,197	828,716	13,094	293,111
Utah	(1)	(1)	(1)	(1)
Virginia	50,629	(1)	26,519	(1)
West Virginia	704,654	(1)	593,831	(1)
Undistributed	[2] 607,931	[2] 43,021,463	[2] 365,249	[2] 26,780,524
	29,905,355	512,165,131	17,812,579	285,147,156

[1] Included under "Undistributed."

[2] Includes figures for States entered as "(1)" above.

Pig iron shipped from blast furnaces in the United States, 1930 and 1931, by grades

Grade	1930			1931		
	Gross tons	Value		Gross tons	Value	
		Total	Average		Total	Average
Charcoal	81,422	$1,845,545	$22.67	62,195	$1,260,496	$20.27
Foundry	3,139,257	50,484,699	16.08	2,021,859	28,812,509	14.25
Basic	18,601,260	311,508,054	16.75	10,367,377	162,890,061	15.71
Bessemer	6,496,164	118,313,691	18.21	4,371,268	74,996,006	17.16
Low-phosphorus	213,532	4,805,176	22.50	130,858	2,851,989	21.79
Malleable	1,269,989	22,949,526	18.07	778,359	12,779,283	16.42
Forge	58,901	1,034,695	17.57	47,729	763,992	16.01
All other (not ferro-alloys)	44,830	1,223,745	27.30	32,934	792,820	24.07
	29,905,355	512,165,131	17.13	17,812,579	285,147,156	16.01

The American Iron and Steel Institute reports that in 1931 the output of all kinds of pig iron and ferro-alloys was 18,426,354 gross tons, a decrease of 42 per cent compared with 1930.

Pig iron (including ferro-alloys) manufactured in the United States, 1930 and 1931, in gross tons[1]

State	1930	1931	State	1930	1931
Pennsylvania	10,304,886	5,233,224	Tennessee	864,824	755,919
Ohio	6,804,862	4,189,311	West Virginia		
Illinois	3,344,674	1,964,735	Kentucky		
Alabama	2,394.725	1,671,205	Iowa	804,686	317,059
Indiana	3,934,212	2,327,839	Colorado		
Michigan			Utah		
New York	2,211,434	1,275,274	Minnesota		
Massachusetts					
Maryland	1,087,866	691,788		31,752,169	18,426,354
Virginia					

[1] American Iron and Steel Institute.

AVERAGE VALUES

Values at blast furnaces.—The average value of all kinds of pig iron given in the accompanying table is based on the reports of the manufacturers to the Bureau of Mines. The figures represent the approximate values f. o. b. at the blast furnaces and do not include the values of ferro-alloys. The general average value for all grades of pig iron at the furnaces, exclusive of ferro-alloys, was $16.01 a gross ton in 1931, a decrease of 7 per cent from 1930.

Average value per gross ton of pig iron at blast furnaces in the United States, 1927–1931

State	1927	1928	1929	1930	1931
Alabama	$18.55	$16.71	$16.19	$13.55	$12.38
Illinois	19.17	17.96	18.46	17.80	16.89
Indiana	18.01	16.56	16.69	16.54	16.53
Michigan	20.00	19.00	16.76	18.08	17.25
New York	16.99	16.85	17.88	17.80	15.35
Ohio	18.34	16.93	17.30	17.05	16.08
Pennsylvania	19.04	17.61	18.29	18.13	17.04
Tennessee	21.73	18.70	18.46	19.64	22.39
Virginia	20.99	19.72	(1)	(1)	(1)
Wisconsin	(1)	(1)	----------	----------	----------
Other States[2]	17.73	17.10	16.83	15.85	14.81
Average for United States	18.53	17.27	17.61	17.13	16.01

[1] Included under "Other States."

[2] 1927–28: Colorado, Kentucky, Maryland, Massachusetts, Minnesota, Utah, West Virginia, and Wisconsin; 1929–30: Colorado, Kentucky, Maryland, Massachusetts, Minnesota, New Jersey, Utah, Virginia, and West Virginia; 1931: Colorado, Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Utah, Virginia, and West Virginia.

Commercial quotations.—The average monthly prices, according to published market quotations, of foundry, basic, and Bessemer pig iron at Valley furnaces and of foundry pig iron at Birmingham furnaces are summarized in the following table.

Average monthly prices per ton of chief grades of pig iron, 1930 and 1931 [1]

Month	Foundry pig iron at Valley furnaces		Foundry pig iron at Birmingham furnaces		Bessemer pig iron at Valley furnaces		Basic pig iron at Valley furnaces	
	1930	1931	1930	1931	1930	1931	1930	1931
January	$18.50	$17.00	$15.00	$13.96	$19.00	$17.50	$18.50	$17.00
February	18 50	16.79	14.71	13.00	19.00	17.29	18.50	16.79
March	18.50	16.50	14.38	12.67	19.00	17.00	18.50	16.50
April	18.50	16.50	14.00	12.10	19.00	17.00	18.50	16.50
May	18.50	16.44	14.00	12.00	19.00	17.00	18.50	16.38
June	18.50	16.00	14.00	12.00	19.00	17.00	18.50	15.50
July	18.12	16.00	14.00	12.00	18.62	17.00	18.12	15.50
August	18.00	16.00	14.00	12.00	18.50	17.00	18.00	15.50
September	17.88	16.00	14.00	12.00	18.38	17.00	17.76	15.50
October	17.22	16.00	14.00	12.00	17.85	16.93	17.00	15.43
November	17.00	16.00	14.00	12.00	17.50	16.50	17.00	15.00
December	17.00	15.75	14.00	12.00	17.50	16.25	17.00	15.00
Average	18.02	16.25	14.17	12.31	18.53	16.96	17.99	15.88

[1] Metal Statistics, 1932.

PRODUCTION BY GRADES AND BY FUEL USED AND BLAST FURNACES

The statistics of production of pig iron, by grades and by fuel used, from 1927 to 1931 and the number of furnaces in blast in 1930 and 1931 have been published by the American Iron and Steel Institute, as shown in the tables that follow. These figures include ferro-alloys. Metals produced by the use of electricity and by the use of coke and electricity together are included in coke pig iron.

Pig iron (including ferro-alloys) manufactured in the United States, 1927–1931, by grades, in gross tons

Grade	1927	1928	1929	1930	1931
Bessemer and low-phosphorus	9,105,915	9,013,847	9,877,240	7,314,749	4,635,648
Basic	19,357,064	22,124,410	24,911,654	18,393,384	10,174,447
Forge	144,532	88,362	167,930	50,696	36,482
Foundry	5,504,419	4,209,790	4,446,011	3,622,779	2,133,939
Malleable	1,699,583	1,922,970	2,312,813	1,571,512	945,664
Ferrosilicon	278,277	303,595	341,222	337,640	211,284
Spiegeleisen	100,720	419,213	476,655	362,386	234,808
Ferromanganese	293,626				
White, mottled, direct castings, and other ferro-alloys	81,509	73,527	80,458	99,023	54,082
	36,565,645	38,155,714	42,613,983	31,752,169	18,426,354

Pig iron (including ferro-alloys) manufactured in the United States, 1927–1931, by fuel used, in gross tons

Fuel used	1927	1928	1929	1930	1931
Pig iron:					
Coke	35,693,663	37,258,688	41,619,022	30,924,327	17,911,566
Charcoal	164,569	142,960	138,193	96,580	46,213
	35,858,232	37,401,648	41,757,215	31,020,907	17,957,779
Ferro-alloys: Coke, charcoal, electricity, etc.	707,413	754,066	856,768	731,262	468,575
	36,565,645	38,155,714	42,613,983	31,752,169	18,426,354

The number of furnaces in blast on June 30 and December 31 and the total number of stacks recorded for 1930 and 1931, exclusive of electric reduction furnaces, were as follows:

Blast furnaces (including ferro-alloy blast furnaces) in the United States, 1930 and 1931

State	In blast June 30, 1930	Dec. 31, 1930			In blast June 30, 1931	Dec. 31, 1931		
		In	Out	Total		In	Out	Total
Alabama	14	8	17	25	12	6	19	25
Colorado	2	2	3	5	1	--------	5	5
Illinois	15	10	15	25	7	7	18	25
Indiana	11	7	11	18	6	5	13	18
Kentucky	1	1	1	2	1	--------	2	2
Maryland	4	2	4	6	3	2	3	5
Massachusetts	1	1	--------	1	1	--------	1	1
Michigan	7	5	4	9	4	3	5	8
Minnesota	2	1	2	3	--------	--------	3	3
Mississippi	--------	--------	1	1	--------	--------	1	1
Missouri	--------	--------	2	2	--------	--------	1	1
New Jersey	--------	--------	2	2	--------	--------	2	2
New York	12	5	16	21	5	6	13	19
Ohio	36	16	42	58	23	12	46	58
Pennsylvania	53	31	73	104	27	17	81	98
Tennessee	1	2	4	6	--------	--------	6	6
Utah	1	1	--------	1	1	1	--------	1
Virginia	1	2	6	8	--------	--------	7	7
West Virginia	3	3	--------	3	2	2	1	3
	164	97	203	300	93	61	227	288

FOREIGN TRADE IN PIG IRON

Imports of pig iron into the United States in 1931 were 84,411 gross tons, valued at $978,683, a decrease of 38 per cent in quantity and 46 per cent in total value compared with 1930. India was again the chief source of imported pig iron, supplying 80 per cent of the total; the Netherlands, Canada, and the United Kingdom were the other important sources, supplying 15 per cent of the total.

Pig iron imported into the United States, 1927–1931, by countries, in gross tons

Country	1927	1928	1929	1930	1931
North America:					
Canada	725	1,015	7,382	664	2,789
Mexico	97	423	387	41	
Europe:					
Belgium	699	272	284	669	300
France	3,000	30	101		25
Germany	9,211	695	103	50	202
Netherlands	29,380	26,989	24,189	6,243	7,209
Norway		1,186	3,400	2,610	227
Sweden	1,700	2,720	3,534	4,092	1,900
United Kingdom	21,129	50,944	39,140	14,239	2,656
Asia:					
Hong Kong					2
India, British	66,627	56,420	69,243	108,261	67,930
Japan				102	20
Kwantung				60	1,098
Oceania: Australia					53
	132,568	140,694	147,763	137,031	84,411
Value	$2,254,355	$2,232,094	$2,398,488	$1,806,754	$978,683

Exports of pig iron from the United States in 1931 were 6,719 gross tons, valued at $150,658, a decrease of 51 per cent in quantity and 48 per cent in total value compared with 1930. The average value of the pig iron exported was $22.42 a ton in 1931 compared with $21.34 a ton in 1930. Canada was again the best customer, taking 51 per cent of the total in 1931.

Pig iron exported from the United States, 1930 and 1931, by countries, in gross tons

Country	1930	1931
North America:		
Canada	9,767	3,408
Cuba	304	250
Mexico	106	192
Panama	420	161
Other countries	34	32
South America:		
Chile	201	56
Colombia	122	88
Peru		350
Other countries	26	50
Europe:		
Belgium	722	261
France	705	206
Germany	360	70
Europe—Continued.		
Italy		27
United Kingdom	71	714
Asia:		
China	71	142
Japan	496	637
Philippine Islands	254	48
Oceania:		
Australia	12	12
New Zealand		15
	13,671	6,719
Value	$291,683	$150,658

WORLD PRODUCTION OF PIG IRON, BY COUNTRIES

The accompanying table shows the predominance of the United States in the manufacture of pig iron and, with the table giving exports from the United States, indicates that the consumption in the principal European countries is still comparatively small.

Pig iron (including ferro-alloys) produced, 1927–1931, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1927	1928	1929	1930	1931
Australia	525,525	417,468	337,975	[1] 350,000	[1] 300,000
Austria	432,749	458,451	458,973	296,824	145,037
Belgium	3,709,090	3,856,990	4,040,530	3,365,240	3,231,580
Brazil [2]	70,000	70,000	70,000	70,000	70,000
Canada	778,220	1,099,578	1,189,037	825,440	473,245
China	411,148	[1] 300,000	[1] 300,000	[1] 300,000	[1] 300,000
Chosen	129,022	148,652	155,514	151,378	[1] 150,000
Czechoslovakia	1,260,363	1,569,264	1,644,515	1,437,089	1,164,726
Finland	11,860	8,470	6,608	3,444	12,329
France	9,294,620	10,072,100	10,362,000	10,280,000	8,300,000
Germany (exclusive of the Saar)	13,088,798	11,803,565	13,239,455	9,698,421	6,063,048
Saar	1,770,718	1,936,184	2,104,940	1,912,444	1,515,429
Great Britain	7,409,951	6,717,400	7,701,200	6,296,259	3,818,418
Hungary	300,237	285,461	367,951	257,226	159,630
India, British	1,163,523	1,072,052	1,417,563	1,198,802	[1] 1,100,000
Italy	529,489	554,113	726,544	587,594	552,852
Japan [3]	911,261	1,540,465	1,514,835	1,656,175	[1] 1,700,000
Luxemburg	2,732,000	2,770,066	2,906,093	2,473,714	2,053,158
Mexico	40,415	49,442	60,230	57,826	[1] 60,000
Netherlands	203,692	258,224	253,776	272,718	256,717
New Zealand	3,437	6,464	4,464	8,205	3,516
Norway	110,416	126,598	153,395	144,836	118,837
Philippine Islands	200	209	166	173	[1] 200
Poland	618,209	683,951	705,532	477,949	347,114
Rumania	63,498	70,123	72,346	68,843	[1] 70,000
Russia	[4] 2,953,514	[4] 3,281,977	[4] 4,018,700	[4] 4,982,200	5,007,000
Spain	593,070	562,821	752,618	621,891	479,215
Sweden	454,518	437,512	523,829	496,410	417,506
Union of South Africa	30,610	9,057	16,510	29,726	8,940
United States	37,152,524	38,768,113	43,297,937	32,261,791	18,722,097
Yugoslavia	22,651	29,303	30,885	35,011	37,733
	86,775,000	88,964,000	98,434,000	80,617,000	56,638,000

[1] Approximate production.
[2] Official estimate of annual production.
[3] Includes pig iron produced at Government and other steelworks for conversion into steel.
[4] Year ended Sept. 30.

FERRO-ALLOYS

PRODUCTION, SHIPMENTS, VALUE, AND PRICES

The shipments of ferro-alloys of all classes in 1931 were 398,295 gross tons, valued at $30,764,549, a decrease of 39 per cent in quantity and 41 per cent in total value compared with 1930.

The production of ferro-alloys was 466,969 gross tons in 1931 compared with 732,518 tons in 1930, a decrease of 36 per cent. Ferro-alloys were made in 1931 at 10 blast furnaces, 12 electric furnaces, and 1 alumino-thermic plant; in addition, 1 plant made ferrosilicon and 1 plant made ferrophosphorus as a by-product.

Ferro-alloys shipped from furnaces in the United States, 1930 and 1931, by varieties

Variety of alloy	1930		1931	
	Gross tons	Value	Gross tons	Value
Ferromanganese	273,640	$25,865,783	159,168	$12,999,329
Spiegeleisen	94,918	2,469,861	55,327	1,313,068
Ferrosilicon (7 per cent or more silicon)	234,328	10,430,720	153,063	7,213,265
Ferrotungsten	736	1,603,903	870	1,690,298
Ferrovanadium	831	2,244,304	616	1,613,381
Other varieties [1]	45,787	9,285,649	29,251	5,935,208
	650,240	51,900,220	398,295	30,764,549

[1] Ferrochromium, ferromolybdenum and calcium-molybdenum compounds, ferrophosphorus, ferrotitanium, ferrozirconium, silicomanganese and silicospiegeleisen, and zirconium-ferrosilicon.

The following records of average contract prices of ferromanganese and of spiegeleisen, by months, for the last four years show considerable fluctuation. The ferromanganese prices are quoted for material "delivered at Pittsburgh"; those for spiegeleisen are prices at producers' furnaces.

Quoted prices per ton of ferromanganese and spiegeleisen, 1928–1931 [1]

Month	Ferromanganese (delivered at Pittsburgh)				Spiegeleisen (at producers' furnaces)			
	1928	1929	1930	1931	1928	1929	1930	1931
January	$104.79	$109.79	$104.79	$89.79	$32.00	$34.00	$34.00	$30.00
February	104.79	109.79	103.79	89.79	32.00	34.00	34.00	30.00
March	104.79	109.79	103.79	89.79	32.00	34.00	34.00	30.00
April	104.79	109.79	103.79	89.79	32.00	34.00	34.00	30.00
May	108.19	109.79	103.79	89.79	32.00	34.00	34.00	30.00
June	109.79	109.79	103.79	89.79	32.00	34.00	34.00	30.00
July	109.79	109.79	103.79	89.79	33.00	34.00	33.00	30.00
August	109.79	109.79	103.79	89.79	33.00	33.20	33.00	30.00
September	109.79	109.79	103.79	89.79	33.00	33.50	33.00	30.00
October	109.79	109.79	103.79	89.79	33.00	34.00	33.00	30.00
November	109.79	109.79	103.79	89.79	33.00	34.00	33.00	30.00
December	109.79	104.79	93.25	79.79	34.00	34.00	30.00	27.00

[1] Steel: Vol. 90, Jan. 4, 1932.

Ferromanganese.—The shipments of ferromanganese in 1931 amounted to 159,168 gross tons, a decrease of 42 per cent from 1930. The average value per ton f. o. b. furnaces reported for ferromanganese was $81.67 in 1931 compared with $94.52 in 1930. Ferromanganese was made at 5 furnaces by 5 producers in 1931 and at 8 furnaces by 6 producers in 1930.

The production of ferromanganese in 1931 was 166,937 gross tons, containing about 131,200 tons of manganese (metal), an average of 78.59 per cent of manganese. In the production of ferromanganese there were used 287,973 gross tons of foreign manganese ore, 10,945 tons of foreign ferruginous manganese ore, 12,277 tons of domestic manganese ore, 8,269 tons of iron ore, and 3,405 tons of cinder, scale, and scrap. The quantity of manganese ore used per ton of ferromanganese made was 1.799 tons in 1931, 1.792 tons in 1930, and 1.894 tons in 1929. Of the foreign manganese ore used in 1931 Russia supplied 168,580 gross tons, Brazil 62,630 tons, India 26,267 tons, Africa 26,133 tons, and Chile 4,363 tons. The quantity of domestic manganese ore used in the manufacture of ferromanganese in 1931 represented 4.1 per cent of the total manganese ore used compared with 6.7 per cent in 1930.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1927–1931

Year	Ferromanganese produced			Materials consumed (gross tons)				Manganese ore used per ton of ferromanganese made (gross tons)
	Gross tons	Manganese contained		Manganese ore		Iron and manganiferous iron ores	Cinder, scale, and scrap	
		Per cent	Gross tons	Foreign	Domestic			
1927	294,991	78.95	232,900	[1] 564,725	25,298	12,735	8,570	2.000
1928	319,770	78.62	251,400	566,859	37,827	23,159	8,395	1.891
1929	339,205	79.30	269,000	614,763	27,558	47,735	7,811	1.894
1930	274,830	78.59	216,000	459,478	32,969	51,039	9,712	1.792
1931	166,937	78.59	131,200	287,973	12,277	19,214	3,405	1.799

[1] Includes Puerto Rican ore.

Manganese ore used in manufacture of ferromanganese in the United States, 1927–1931, in gross tons

Source of ore	1927	1928	1929	1930	1931
Africa	41,470	25,039	28,592	62,913	26,133
Brazil	245,485	218,181	228,737	138,757	62,630
Chile	3,746	5,118	1,187	1,705	4,363
Cuba	9,408	14,280	2,050		
India	78,548	96,232	86,547	44,667	26,267
Puerto Rico	1,666				
Russia	184,402	208,009	267,600	211,436	168,580
Turkey			50		
United States	25,298	37,827	27,558	32,969	12,277
	590,023	604,686	642,321	492,447	300,250

Quantity and tenor of manganese ore and ferruginous manganese ore used in manufacture of ferromanganese in the United States in 1931

Source of ores	Manganese ore		Ferruginous manganese ore	
	Gross tons	Manganese content (per cent, natural)	Gross tons	Manganese content (per cent, natural)
Africa	26,133	49.79		
Australia			652	10.19
Brazil	62,630	43.42	7,034	32.37
Chile	4,363	46.64		
India	26,267	50.75	3,259	26.57
Russia	168,580	49.29		
United States	12,277	39.21		
	300,250	47.79	10,945	29.32

Spiegeleisen.—The shipments of spiegeleisen amounted to 55,327 gross tons (42 per cent less than in 1930). The average value per ton at the furnaces was $23.73 in 1931 and $26.02 in 1930.

Ferrosilicon.—The production of ferrosilicon amounted to 196,725 gross tons in 1931 compared with 315,684 tons in 1930. Of the ferrosilicon produced in 1931, 52.10 per cent was made by the blast-furnace process, 47.77 per cent by the electric-furnace process, and 0.13 per cent as a by-product of the manufacture of artificial abrasives in electric furnaces. The shipments of ferrosilicon amounted to 153,063 gross tons containing 38,520 tons of silicon in 1931 compared with 234,328 tons containing 56,253 tons of silicon in 1930.

Ferrotungsten.—The production of ferrotungsten in 1931 was 847 gross tons containing 1,500,879 pounds of tungsten (metal), an average of 79.15 per cent of tungsten. The greater part of the ferrotungsten produced in 1931 was made from foreign ores, chiefly from China and Burma. Most of the domestic ores used came from Colorado and Nevada.

The shipments of ferrotungsten in 1931 amounted to 870 gross tons containing 1,543,620 pounds of tungsten, and the average value per pound of contained tungsten was $1.10 f. o. b. furnaces compared with $1.25 in 1930.

Ferrovanadium.—The production of ferrovanadium in 1931 amounted to 373 gross tons containing 310,781 pounds of vanadium (metal), an average of 37.19 per cent of vanadium. Ferrovanadium was made at 4 furnaces by 3 producers in 1931 and at 5 furnaces by 4 producers in 1930. The ferrovanadium produced in 1931 was made chiefly from patronite and its oxidation products from Peru and from vanadium pentoxide made from roscoelite mined in Colorado.

The shipments of ferrovanadium in 1931 were 616 gross tons containing 515,217 pounds of vanadium and were valued at the furnaces at an average of $3.13 per pound of contained vanadium compared with $3.15 in 1930.

IMPORTS AND EXPORTS

The imports of the alloys of the rarer metals are not all reported separately but are grouped as shown in the next table. Ferromanganese constituted the bulk of the imports in 1931; 47 per cent of it came from Canada, 29 per cent from the United Kingdom, and 15 per cent from Norway.

Prior to the tariff of September 22, 1922, the Bureau of Foreign and Domestic Commerce recorded only the gross weight of the ferro-alloys imported. Since that date the import statistics are not uniform, the gross weight of some ferro-alloys, the content of some, and both the gross weight and the content of some being recorded. The reader should bear in mind this change when comparing the quantities published before and after a change in tariff. The values, however, are comparable.

The exports of ferro-alloys are relatively unimportant. Ferromanganese and spiegeleisen, the exports of which in 1931 were only about one-fifth of those in 1930, constituted the greater part of the total exports in 1931.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1929–1931, by varieties

Variety of alloy	1929		1930	
	Gross tons	Value	Gross tons	Value
Ferromanganese (manganese content) [1]	56,969	$6,126,056	45,001	$4,128,065
Spiegeleisen	13,828	403,853	13,406	381,197
Ferrochrome and chromium:				
Ferrochrome—				
Containing 3 per cent or more carbon (chromium content)	37	8,835	----------	----------
Containing less than 3 per cent carbon	638	206,311	153	31,428
Chrome or chromium metal	21	5,242	----------	----------
Ferrophosphorus	737	59,961	1,005	75,917
Ferrosilicon (silicon content) [2]	9,285	1,388,423	4,541	623,307
Molybdenum and ferromolybdenum (molybdenum content)	1	2,384	65	283,846
Titanium and ferrotitanium	7	2,517	1	496
Tungsten and ferrotungsten (tungsten content)	211	376,230	135	417,906
Ferrovanadium	46	89,229	----------	----------

[1] Includes small quantities of other manganese alloys.
[2] Includes small quantities of chromium and zirconium-silicon and calcium silicide.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1929–1931, by varieties—Continued

Variety of alloy	1931		
	Gross weight (gross tons)	Content (gross tons)	Value
Ferromanganese.			
Containing over 1 per cent carbon	24,234	19,488	$1,713,287
Containing not over 1 per cent carbon	430	348	38,359
Manganese boron, manganese silicon, manganese metal, and spiegeleisen, n. e. s	(3)	431	44,929
Spiegeleisen	9,482	(3)	247,788
Ferrochrome or ferrochromium containing less than 3 per cent carbon	135	91	21,463
Ferrophosphorus	1,839	(3)	134,773
Ferrosilicon:			
Containing 8 per cent and less than 60 per cent silicon	3,758	924	126,509
Containing 60 per cent and less than 80 per cent silicon	25	20	1,888
Chromium and zirconium silicon and calcium silicide	40	(3)	6,629
Silicon aluminum, aluminum silicon	13	(3)	1,800
Ferrosilicon aluminum and ferroaluminum silicon and alsimin	16	(3)	2,149
Ferromolybdenum, molybdenum metal and powder, calcium molybdate, and other compounds and alloys of molybdenum	(3)	94	213,660
Ferrotitanium	1	(3)	379
Tungsten and combinations, in lump, grains, or powder:			
Tungsten metal	(3)	9	11,716
Combinations containing tungsten or tungsten carbide	(3)	(4)	24
Tungstic acid and other compounds of tungsten, n. s. p. f	(3)	1	3,819
Ferrozirconium and zirconium-ferrosilicon	(5)	(3)	312

[3] Not recorded. [4] 3 pounds of tungsten. [5] 496 pounds.

Ferromanganese and ferrosilicon imported into the United States, 1930 and 1931, by countries

[General imports]

Country	Ferromanganese (manganese content)[1]				Ferrosilicon (silicon content)[2]			
	1930		1931		1930		1931	
	Gross tons	Value	Gross tons	Value	Gross tons	Value	Gross tons	Value
Canada	16,216	$2,016,293	8,331	$865,891	3,998	$497,033	442	$71,924
France	170	30,320	180	21,970	10	1,620	--------	----------
Germany	324	24,279	410	20,611	(3)	224	9	1,867
Italy	1,023	159,771	590	82,312	10	1,523	30	4,658
Japan	--------	----------	--------	----------	--------	----------	13	809
Norway	7,458	789,662	2,712	285,963	1,076	130,806	244	26,800
Switzerland	--------	----------	--------	----------	94	11,592	--------	----------
United Kingdom	13,261	971,195	5,105	315,842	(3)	300	--------	----------
Yugoslavia and Albania	--------	----------	436	14,580	--------	----------	--------	----------
	[1]38,452	[1]3,991,520	[1]17,764	[1]1,607,169	[2]5,188	[2]643,098	[2]738	[2]106,058

[1] Includes small quantities of other manganese alloys.
[2] Includes small quantities of chromium and zirconium-silicon and calcium silicide.
[3] Less than 1 ton.

Ferro-alloys and ferro-alloy metals exported from the United States, 1929–1931, by varieties

Variety of alloy	1929		1930		1931	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Ferromanganese [1]	1,574	$59,036	6,189	$145,629	1,306	$38,506
Spiegeleisen [1]						
Tungsten and ferrotungsten (including tungsten wire)	46	325,133	13	221,934	472	624,412

[1] Not separately classified.

STEEL

PRODUCTION

The following tables showing the production of steel were compiled by the American Iron and Steel Institute. No data whatever are available on the value of the output of crude steel at the mills, but the weekly issues and annual statistical reviews of Iron Age give market quotations of prices of steel billets and some of the leading forms of finished steel. The price of both open-hearth and Bessemer steel billets at Pittsburgh in 1931 ranged from $28.80 to $30 a gross ton; in 1930 it ranged from $30.60 to $34 a ton. Tank plates at Pittsburgh ranged from 1.54 to 1.65 cents a pound in 1931 and from 1.6 to 1.83 cents a pound in 1930. Structural shapes at Pittsburgh ranged from 1.5 to 1.65 cents a pound in 1931 and from 1.6 to 1.83 cents a pound in 1930. Automobile body sheets, base No. 22 gage, f. o. b. Pittsburgh, ranged from 3.02 to 3.3 cents a pound in 1931 and from 3.3 to 3.9 cents a pound in 1930.

Bessemer steel ingots and castings manufactured in the United States, 1927–1931, by States, in gross tons

State	1927	1928	1929	1930	1931
Ohio	2,440,235	2,577,728	2,724,864	1,892,021	1,393,875
Pennsylvania	2,108,483	2,293,085	2,427,490	1,732,545	786,767
Illinois	835,254	978,511	1,073,790	718,104	420,569
Other States	807,755	770,871	896,365	692,789	422,235
	6,191,727	6,620,195	7,122,509	5,035,459	3,023,446

Open-hearth steel ingots and castings manufactured in the United States, 1927–1931, by States, in gross tons

State	1927	1928	1929	1930	1931
New England States	256,716	285,767	325,232	214,425	175,673
New York and New Jersey	2,003,599	2,323,333	2,541,856	1,764,976	1,144,839
Pennsylvania	13,708,156	15,261,713	17,504,807	12,488,175	7,384,091
Ohio	8,266,708	10,179,096	10,241,579	7,152,526	4,954,069
Indiana	5,118,620	5,971,416	6,235,333	4,742,297	2,746,899
Illinois	2,741,472	3,239,669	3,607,810	2,514,799	1,450,637
Other States	5,973,064	6,852,962	7,896,271	6,171,974	4,653,358
	38,068,335	44,113,956	48,352,888	35,049,172	22,509,566

According to these tables there was a decrease of 40 per cent in the production of Bessemer steel and of 36 per cent in that of open-hearth steel in 1931 compared with 1930; the total production of steel decreased 36 per cent also. Of the total output in 1931, 86.76 per cent was open-hearth, 11.65 per cent Bessemer, and 1.59 per cent other classes of steel.

Of the total output of open-hearth steel 22,130,398 gross tons were made by the basic process and 379,168 tons by the acid process compared with 34,268,316 tons of basic steel and 780,856 tons of acid steel in 1930.

The production of steel by the electric process decreased 33 per cent compared with 1930.

Steel electrically manufactured in the United States, 1927–1931, in gross tons

Year	Ingots	Castings	Total	Year	Ingots	Casting	Total
1927	371,278	294,809	666,087	1930	307,418	305,181	612,599
1928	453,692	348,568	802,260	1931	235,376	175,566	410,942
1929	532,392	419,039	951,431				

Figures for the total production of electric steel in 1931 include 232,113 tons of alloy-steel ingots and castings that were alloyed with nickel, vanadium, tungsten, chromium, molybdenum, and other metals (186,027 tons of ingots and 46,086 tons of castings) compared with 300,520 tons (239,280 tons of ingots and 61,240 tons of castings) so alloyed in 1930.

The number of completed plants equipped for the manufacture of steel by the electric process was 250 on December 31, 1931, compared with 245 plants at the end of 1930.

Steel produced in the United States, 1930 and 1931, in gross tons

Year	Bessemer	Open-hearth	Crucible	Other steel	Total
1930	5,035,459	35,049,172	2,253	612,599	40,699,483
1931	3,023,446	22,509,566	1,547	410,942	25,945,501

FOREIGN TRADE IN STEEL

The following tables show the imports and exports of certain iron and steel products.

Iron and steel imported into the United States, 1929–1931

Article	1929		1930		1931	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Bar iron	2,930	$197,762	1,376	$101,624	854	$48,323
Boiler and other plate of iron and steel	3,243	115,836	1,892	59,837	755	33,249
Iron and steel scrap	90,479	1,466,525	27,482	395,161	16,279	117,954
Rails for railways	6,236	184,921	8,307	240,331	5,007	99,607
Sheets of iron or steel, skelp, saw plates and steel, n. e. s	25,218	1,222,151	26,594	1,247,891	16,152	600,637
Steel ingots, bars, etc	26,493	1,109,061	22,313	749,010	20,023	518,563
Tin and terne plates	286	71,824	261	67,102	196	42,704
Wire and articles made from wire		4,400,592		2,850,389		1,925,673
Wire rods	15,653	1,045,334	8,843	585,191	7,114	472,240
Other advanced manufactures		3,914,562		2,216,581		989,908

Iron and steel exported from the United States, 1930 and 1931

Article	1930		1931	
	Gross tons	Value	Gross tons	Value
Semimanufactures:				
Steel ingots, blooms, billets, slabs, and sheet bars	17,032	$733,005	7,965	$331,707
Iron and steel bars and rods—				
Iron bars	1,822	150,307	1,017	95,954
Steel bars	81,089	4,689,186	42,513	2,328,632
Alloy-steel bars	6,667	910,623	2,968	498,606
Wire rods	39,779	1,876,163	32,125	1,297,110
Iron and steel plates, sheets, skelp, and strips—				
Boiler plates	7,013	331,652	500	32,468
Other plates, not fabricated	91,325	4,526,620	41,973	1,878,230
Skelp iron or steel	119,887	5,193,246	56,498	2,369,366
Iron or steel sheets, galvanized	93,485	8,798,144	51,523	4,294,442
Steel sheets, black	137,919	10,342,884	91,786	6,917,787
Iron sheets, black	11,482	1,097,357	5,523	446,589
Strip steel, cold rolled	10,487	980,434	8,897	739,545
Hoop, band, and scroll iron or steel	28,828	1,712,806	19,333	1,094,930
Tin plate, terneplate, and taggers tin	216,517	24,201,977	84,433	7,841,193
Manufactures—steel-mill products:				
Structural iron and steel—				
Structural shapes—				
Not fabricated	140,415	6,234,346	88,710	3,436,880
Fabricated	57,607	5,525,213	24,862	2,327,063
Ship and tank plates, punched or shaped	5,629	316,687	1,525	84,269
Metal lath	5,579	848,107	2,408	350,046
Other structural shapes	40,239	3,303,806	5,745	358,140
Railway track material—				
Rails for railways	95,179	3,580,402	33,108	1,288,811
Rail joints, splice bars, fishplates, and tie-plates	11,637	935,053	4,897	377,723
Switches, frogs, and crossings	3,382	749,251	1,265	269,837
Railroad spikes	2,735	177,877	1,158	74,387
Railroad bolts, nuts, washers, and nut locks	1,758	270,945	769	154,634
Tubular products—				
Boiler tubes	14,686	2,004,538	7,070	885,816
Casing and oil-line pipe	62,106	6,707,743	21,973	2,468,798
Welded black pipe	57,070	5,448,956	34,309	2,805,851
Welded galvanized pipe	36,328	3,619,792	26,129	2,371,674
Malleable-iron screwed pipe fittings	10,742	3,413,299	4,510	1,400,764
Cast-iron screwed pipe fittings	6,055	1,426,971	2,142	526,544
Cast-iron pressure pipe and fittings	11,385	957,294	12,995	653,796
Cast-iron soil pipe and fittings	14,035	1,282,829	6,049	480,678
Wire and manufactures—				
Barbed	35,183	2,054,848	21,459	1,049,148
All other	44,519	6,257,168	25,114	3,394,517
Nails and bolts (except railroad)—				
Cut nails	473	55,880	137	16,186
Horseshoe nails	751	180,940	619	147,331
Wire nails	8,471	536,273	8,838	484,860
All other nails, including tacks and staples	4,645	818,743	3,059	444,559
Bolts, nuts, rivets, and washers (except railroad)	10,131	2,092,572	4,855	1,048,532
Castings and forgings—				
Horseshoes	181	32,102	153	21,128
Iron and steel, including car wheels and axles	39,297	6,297,210	21,141	2,858,663
Advanced manufactures:				
House-heating boilers and radiators	----------	859,452	----------	485,201
Tools—				
Axes	----------	590,471	----------	263,776
Hammers and hatchets	----------	210,412	----------	100,118
Saws, wood and metal cutting	----------	1,684,122	----------	1,141,696
Shovels and spades	----------	218,206	----------	113,372
All other tools	----------	8,995,682	----------	6,456,128

MANGANESE AND MANGANIFEROUS ORES[1]

By R. H. Ridgway[2]

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INTRODUCTION

Before the World War domestic production of manganese ore was very small compared with domestic consumption. The average annual output from 1900 to 1914, inclusive, was about 5,000 long tons; imports during the same period averaged about 223,000 long tons. At the time of the World War the requirement for manganese in the United States expanded, and some of the transport of imported ore was seriously menaced. Domestic production grew under the impetus of exceptionally high prices and urgent Government requests for increased output. In 1918 production reached a peak of nearly 306,000 tons, about 38 per cent of the total manganese-ore requirements in the United States during that year. The average grade of domestic ore was not, however, as high as the grade of ore from foreign sources, but domestic ores were commonly mixed with higher-grade foreign ores. Pre-war requirements as to grade were also greatly modified, the manganese content of ferromanganese being reduced from 80 to 60 and 70 per cent; some steel makers who formerly used ferromanganese substituted spiegeleisen, which could be made from the lower-grade domestic ores.

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[1] Work on manuscript completed June, 1932.

[2] Statistics on domestic output prepared by H. W. Davis and data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

This state of affairs terminated abruptly with the signing of the armistice. Prices declined immediately, and many war-time contracts were canceled; in consequence, much domestic production became unprofitable, and a number of producers who had developed properties at a considerable cost, expecting the war to last much longer, faced heavy losses. Congress intervened, however, with appropriations to reimburse the producers for their war-time losses.

Under postwar conditions domestic production dwindled rapidly and by 1922 was only 13,000 tons. Meanwhile, a demand for tariff protection had developed. Proponents of the tariff claimed that a domestic supply of such an important raw material as manganese ore was essential to the country in war and that the experience during the World War indicated that a substantial manganese-ore industry could be developed under proper tariff protection. Opponents of the tariff claimed that the war-time manganese-ore production was largely uneconomical and that the known manganese-ore reserves of the country did not justify the assumption that a substantial industry could be developed in competition with large high-grade foreign deposits, even under a protective tariff.

The tariff act of 1922, which became effective during the latter part of that year, established a duty of 1 cent per pound of contained manganese on imported ores containing more than 30 per cent manganese. The effect of this act was immediately reflected in the domestic price of manganese ore. Domestic production of manganese ore rose to a postwar peak of 98,000 tons in 1925, about 14 per cent of the domestic requirements in that year. Nearly half of the 1925 output was derived from the rhodochrosite ores of the Butte district, and about a fifth of the total represented the production of battery ores from the Philipsburg (Mont.) district. Imports increased from 425,000 tons in 1922 to 615,000 tons in 1925.

The increase in domestic production from 1922 to 1925 was accompanied by a steady increase in price; but by 1925 the production of foreign ores had increased to such an extent that competition for the world's markets was severe, and the price of manganese began a steady decline. At the same time changing design in radio receiving sets caused the demand for battery ore to drop steadily. These factors were reflected in the decrease in domestic production to an average of about 46,000 tons in the period 1926 to 1928, due largely to curtailment in the Butte and Philipsburg districts.

Meanwhile, more and more attention was directed to beneficiation of low-grade ore bodies. Many processes were developed to treat various types of low-grade ores. The outstanding of these was the sintering of rhodochrosite ores of the Butte district, which began in 1927. As a result of increased production in this district, the domestic production of high-grade manganese ore rose to more than 60,000 tons in 1929.

While the tariff was being considered in 1929 Congress was requested by the manganese-ore producers to increase the tariff on manganese ore and to extend the duty to ores containing less than 30 per cent manganese. It was claimed that the domestic industry had progressed under the protection granted it in 1922 and that further protection was needed to put the processes being developed to treat low-grade ores on a commercial basis. Opponents of the tariff contended that the record of production under seven years of protection proved the contention made by them in 1922—that the known reserves were insufficient to provide an adequate supply of manganese, even with tariff protection. They also contended that the imposition of high duties to sustain production from low-grade ore bodies was uneconomic and placed an unnecessary burden on the steel industry. The price of manganese continued to decline steadily during 1929.

The tariff act which became effective June 18, 1930, continued the duty of 1 cent per pound of contained manganese and extended the duty to cover ores containing as low as 10 per cent manganese. Prices of manganese continued to fall during 1930; imports declined; and domestic production showed a small increase but was equivalent to only 11 per cent of imports.

This résumé of the domestic manganese-ore industry through 1930 provides a perspective that is useful in viewing the events of the industry in 1931.

SUMMARY FOR 1931

The fact that manganese is consumed mainly in steel production makes the manganese market dependent upon steel output. The general slowing down of the steel trade throughout the world in 1931 caused curtailment of manganese-ore production in all principal producing localities.

With excess production and greatly reduced demand, prices weakened as the year progressed. Competition from Soviet Russia was felt keenly by other producers, but the lessened world consumption caused the Russians to revise their production schedule downward to 960,000 metric tons for the fiscal year 1931 compared with an actual production of 1,444,000 metric tons in the fiscal year 1930. The effects of the low market were reflected in the greatly reduced exports from India, Brazil, and Gold Coast. The advent of the new South African production into a market already adequately covered by existing production proved unfortunate, and the Postmasburg operations were shut down in September, 1931, after a year of large-scale production.

Imports of manganese ore into the two principal consuming countries, the United States and France, decreased 14 and 33 per cent, respectively. There was little change in the relative importance of the various countries supplying the United States; but in France shipments from the Union of South Africa to an extent replaced decline in imports from India, Russia, and Gold Coast.

In the United States 1931 was characterized by decreased production, falling prices, decreased imports, and decreased consumption. Domestic mines shipped 39,242 long tons of manganese ore (35 per cent or more manganese) compared with 67,035 tons in 1930. Shipments of ferruginous manganese ore amounted to 64,062 tons compared with 77,417 tons in 1930; and shipments of manganiferous iron ore amounted to 217,352 tons compared with 707,973 tons in 1930. Production of ferromanganese decreased from 274,830 tons in 1930 to 166,937 tons in 1931, and production of spiegeleisen decreased from 87,059 tons in 1930 to 67,800[3] tons in 1931. Imports of manganese ore amounted to 502,518 long tons compared with 585,568 tons in 1930; and stocks of manganese ore in bonded warehouses increased from 413,216 long tons, containing 201,550 tons of metallic manganese, at the beginning of 1931 to 613,814 tons of ore, containing 300,410 tons of manganese, at the end of the year.

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[3] Steel, Manganese Ore and Alloy Statistics: Vol. 90, No. 1, Jan. 4, 1932, p. 198.

DOMESTIC PRODUCTION

CLASSIFICATION OF MANGANESE-BEARING ORES

Manganese-bearing ores produced in the United States have been divided into four main groups: (1) Metallurgical-grade ores, comprising manganese ores containing 35 per cent or more manganese used in the manufacture of iron and steel, ferruginous manganese ore containing 10 to 35 per cent manganese, manganiferous iron ore containing 5 to 10 per cent manganese, and manganiferous zinc residuum; (2) battery ore; (3) fluxing ores, including ores that may contain a few ounces of silver and are rich enough in manganese to make them valuable chiefly for fluxing purposes in nonferrous smelters; and (4) miscellaneous ores—those shipped to brick manufacturers, glass makers, and manufacturers of manganese chemicals.

The following table shows the production of manganese-bearing ores, classified as stated, for the past five years.

Manganiferous raw materials shipped in the United States, 1927–1931, in long tons

Year	Metallurgical ore [1]				Battery ore [2]	Miscellaneous manganese ore	Fluxing ore [3]
	Manganese ore (35 per cent or more manganese)	Ferruginous manganese ore (10 to 35 per cent manganese)	Manganiferous iron ore (5 to 10 per cent manganese)	Manganiferous zinc residuum			
1927	[4] 27,730	148,291	1,310,127	184,771	17,011	(4)	3,190
1928	[4] 31,430	90,581	1,085,401	171,107	15,430	(4)	1,650
1929	[4] 47,597	78,191	1,110,067	168,363	12,782	(4)	----------
1930	53,326	77,417	707,973	113,060	11,757	1,952	----------
1931	29,874	64,062	217,352	96,990	7,952	1,416	----------

[1] Ferrous metallurgy only.
[2] Recorded as "chemical manganese ore" in reports of this series prior to 1930.
[3] Nonferrous smelters.
[4] Small quantities of miscellaneous ore included with metallurgical ore.

METALLURGICAL MANGANESE ORE

Shipments of metallurgical manganese ore amounted to 29,874 long tons, valued at $395,399, in 1931, compared with 53,326 tons, valued at $971,515, in 1930. The 1931 total was derived from nine States; but Montana, Georgia, and Arkansas furnished 92 per cent of the total, Montana alone contributing 57 per cent. The remaining six States—California, New Mexico, Tennessee, Texas, Virginia, and West Virginia—yielded quantities ranging from 29 tons in West Virginia to 1,072 tons in New Mexico. The following table shows the shipments of this class of material by States for the past five years.

Metallurgical manganese ore (exclusive of fluxing ore) shipped from mines in the United States, 1927–1931, by States, in long tons [1]

State	1927	1928	1929	1930	1931
Alabama	(2)	(2)	------	------	------
Arizona	3, 905	3, 507	2, 655	364	------
Arkansas	2, 605	3, 623	4, 308	3, 276	4, 028
California	------	------	569	162	40
Colorado	(2)	------	------	------	------
Georgia	489	4, 727	2, 521	18, 897	6, 491
Idaho	3, 181	(2)	1, 326	------	------
Montana	10, 124	12, 044	29, 945	22, 731	17, 088
Nevada	1, 357	------	------	1, 489	------
New Mexico	2, 190	2, 627	2, 969	2, 574	1, 072
North Carolina	------	10	------	60	------
Tennessee	498	55	523	471	70
Texas	------	------	42	247	155
Utah	27	------	88	------	------
Virginia	2, 583	3, 071	2, 651	3, 055	901
West Virginia	------	------	------	------	29
Undistributed	771	1, 766	------	------	------
	27, 730	31, 430	47, 597	53, 326	29, 874

[1] Includes small quantities of miscellaneous ore, 1927–1929.

[2] Included under "Undistributed."

FERRUGINOUS MANGANESE ORE

Shipments of ferruginous manganese ore amounted to 64,062 long tons, valued at $405,749, in 1931, compared with 77,417 tons, valued at $566,155, in 1930, a decrease of 17 per cent in quantity and 28 per cent in value. Minnesota, Montana, and Georgia were the principal producers of ferruginous manganese ore in 1931, furnishing 82 per cent of the total; Minnesota, the leading State, supplied 41 per cent. The other States producing ore of this class in 1931 were Alabama, Arkansas, Colorado, Idaho, Michigan, and Utah. Shipments by States for the past five years follow.

Ferruginous manganese ore (exclusive of fluxing ore) shipped from mines in the United States, 1927–1931, by States, in long tons

State	1927	1928	1929	1930	1931
Alabama	(1)	------	475	321	1, 321
Arizona	179	214	45	48	------
Arkansas	7, 444	7, 136	13, 774	12, 645	2, 230
Colorado	26, 828	18, 599	17, 770	19, 730	3, 685
Georgia	20, 015	4, 687	5, 310	12, 009	11, 652
Idaho	------	------	38	1, 450	578
Massachusetts	(1)	------	------	------	------
Michigan	14, 763	7, 943	11, 023	------	2, 217
Minnesota	6, 276	3, 487	5, 421	4, 698	26, 567
Montana	10, 332	11, 156	15, 665	11, 875	14, 311
Nevada	3, 310	------	2, 407	3, 363	------
New Mexico	56, 624	36, 250	------	------	------
Tennessee	487	718	241	113	------
Utah	239	286	5, 942	10, 972	1, 501
Virginia	1, 029	105	80	193	------
Undistributed	765	------	------	------	------
	148, 291	90, 581	78, 191	77, 417	64, 062

[1] Included under "Undistributed."

MANGANIFEROUS IRON ORE

Shipments of manganiferous iron ore totaled 217,352 long tons, valued at $570,800, in 1931 compared with 707,973 tons, valued at $1,835,450, in 1930, a decrease of 69 per cent in both quantity and value. Minnesota was the only State shipping manganiferous iron ore in 1931. During the past five years shipments by States were as follows:

Manganiferous iron ore (exclusive of fluxing ore) shipped from mines in the United States, 1927–1931, by States, in long tons

State	1927	1928	1929	1930	1931
Georgia	195	----------	----------	----------	----------
Michigan	59, 976	41, 261	38, 089	----------	----------
Minnesota	934, 599	1, 025, 014	1, 004, 420	693, 546	217, 352
New Mexico	30, 710	19, 081	67, 558	14, 427	----------
Tennessee	----------	45	----------	----------	----------
Virginia	177	----------	----------	----------	----------
Wisconsin	284, 470	----------	----------	----------	----------
	1, 310, 127	1, 085, 401	1, 110, 067	707, 973	217, 352

BATTERY ORE

Shipments of battery ore totaled 7,952 long tons, valued at $281,523, in 1931, compared with 11,757 tons, valued at $432,668, in 1930, a decrease of 32 per cent in quantity and 35 per cent in value. Shipments of ore of this class have declined steadily since 1924, due to imported ore and the newer developments in radio receiving sets. Virtually all the production in 1931 came from Montana; Virginia, the other State shipping, furnished only 150 tons. Shipments of battery ore by States for the past five years follow.

Battery ore [1] shipped from mines in the United States, 1927–1931, by States

Year	Montana (long tons)	Virginia (long tons)	Total	
			Long tons	Value
1927	16,382	629	17,011	$705,137
1928	14,689	741	15,430	621,292
1929	12,382	400	12,782	576,158
1930	11,451	306	11,757	$432,668
1931	7,802	150	7,952	281,523

[1] Recorded as "chemical manganese ore" in reports of this series prior to 1930.

FLUXING ORE

Silver ores high in manganese are especially desirable in localities where nonferrous smelters must handle large quantities of "dry ores," because manganese is slightly more desirable than iron as a flux. Some ores high in silver yet containing a considerable percentage of manganese are valued chiefly for their silver content; such ores are classified as silver ores and are not reported in this chapter. Other ores containing only a few ounces of silver but a high percentage of manganese are valued chiefly for fluxing purposes and are termed fluxing ores.

No fluxing ore has been shipped since 1928. Nevada shipped 1,602 long tons in 1928 compared with 2,161 tons in 1927, and Colorado shipped 48 tons in 1928 compared with 1,029 tons in 1927.

REVIEW BY STATES

The following table shows the shipments of manganese-bearing ore in 1930 and 1931, by States.

Manganese and manganiferous ore (exclusive of fluxing ore) shipped by mines in the United States, 1930 and 1931, by States

	Ore containing 35 per cent or more manganese			Ore containing 10 to 35 per cent manganese			Ore containing 5 to 10 per cent manganese		
	Shippers	Long tons	Value	Shippers	Long tons	Value	Shippers	Long tons	Value
1930									
Metallurgical:									
Alabama				5	321	$2,618			
Arizona	2	364	(1)	1	48	(1)			
Arkansas	4	3,276	$58,172	3	12,645	96,964			
California	2	162	(1)						
Colorado				3	19,730	109,796			
Georgia	2	18,897	(1)	2	12,009	(1)			
Idaho				2	1,450	(1)			
Minnesota				1	4,698	17,837	5	693,546	$1,794,334

[1] Included under "Undistributed."

Manganese and manganiferous ore (exclusive of fluxing ore) shipped by mines in the United States, 1930 and 1931, by States—Continued

	Ore containing 35 per cent or more manganese			Ore containing 10 to 35 per cent manganese			Ore containing 5 to 10 per cent manganese		
	Shippers	Long tons	Value	Shippers	Long tons	Value	Shippers	Long tons	Value
1930									
Metallurgical—Contd.									
Montana	[2] 2	22,731	(1)	2	11,875	(1)			
Nevada	1	1,489	$17,617	2	3,363	(1)			
New Mexico	3	2,574	34,884				1	14,427	$41,116
North Carolina	1	60	(1)						
Tennessee	[2] 2	471	(1)	1	113	(1)			
Texas	2	247	4,147						
Utah				3	10,972	$91,742			
Virginia	[2] 4	3,055	56,791	2	193	1,560			
Undistributed			799,904			245,638			
Total metallurgical	25	53,326	971,515	27	77,417	566,155	6	707,973	1,835,450
Battery:									
Montana	[2,3] 2	11,451	432,668						
Virginia	[2] 1	306							
Total battery	3	11,757	432,668						
Miscellaneous:									
Montana	[2] 3	1,423	33,282						
Tennessee	[2] 1	37							
Virginia	[2] 2	492							
Total miscellaneous	6	1,952	33,282						
	27	67,035	1,437,465	27	77,417	566,155	6	707,973	1,835,450
1931									
Metallurgical:									
Alabama				3	1,321	5,848			
Arkansas	4	4,028	80,915	1	2,230	(1)			
California	1	40	(1)						
Colorado				1	3,685	21,880			
Georgia	3	6,491	(1)	2	11,652	(1)			
Idaho				1	578	(1)			
Michigan				1	2,217	(1)			
Minnesota				1	26,567	162,988	4	217,352	570,800
Montana	[4] 2	17,088	(1)	1	14,311	(1)			
New Mexico	1	1,072	(1)						
Tennessee	1	70	(1)						
Texas	2	155	(1)						
Utah				3	1,501	16,601			
Virginia	[4] 4	901	16,650						
West Virginia	1	29	(1)						
Undistributed			297,834			198,432			
Total metallurgical	19	29,874	395,399	14	64,062	405,749	4	217,352	570,800
Battery:									
Montana	[3,4] 2	7,802	281,523						
Virginia	[4] 1	150							
Total battery	3	7,952	281,523						
Miscellaneous:									
Arizona	1	40	600						
Montana	[4] 3	922	14,342						
Virginia	[4] 3	454	7,257						
Total miscellaneous	7	1,416	22,199						
	24	39,242	699,121	14	64,062	405,749	4	217,352	570,800

[1] Included under "Undistributed."

[2] 2 producers in Montana, 1 in Tennessee, and 2 in Virginia shipped both metallurgical and miscellaneous ore; 1 producer in Montana shipped both battery and miscellaneous ore; and 1 producer in Virginia shipped both metallurgical and battery ore.

[3] Mills through which all ore was shipped; producers not counted.

[4] 1 producer in Montana and 1 in Virginia shipped both metallurgical and miscellaneous ore; 2 producers in Montana shipped both battery and miscellaneous ore; and 1 producer in Virginia shipped both metallurgical and battery ore.

ALABAMA

No shipments of manganese ore were made from Alabama in 1931; but 1,321 long tons of ferruginous manganese ore, valued at $5,848, were shipped, compared with 321 tons, valued at $2,618, in 1930. About 95 per cent of the total was shipped by J. G. Bush from Talladega County. The Margemma Mining Co., which operates the Rock Run Mine in Cherokee County, shipped 1 carload of ore containing 25.87 per cent manganese, 4.27 per cent iron, and 40 per cent silica. The remaining shipment (1 carload) came from a producer in Etowah County.

ARIZONA

Shipments of manganese ore from Arizona in 1931 amounted to only 40 long tons. The ore came from Maricopa County and was used as fertilizer.

ARKANSAS

Shipments of manganese ore from Arkansas amounted to 4,028 long tons, valued at $80,915, in 1931, compared with 3,276 tons, valued at $58,172, in 1930, an increase in both quantity and value. The ore shipped in 1931, most of which was in the form of mill concentrates, averaged (dried) about 51 per cent manganese. Four shippers furnished the total output, the bulk coming from Independence County. Shipments of ferruginous manganese ore amounted to 2,230 long tons in 1931, compared with 12,645 tons in 1930. The ferruginous manganese ore shipped in 1931 averaged (dried) about 27 per cent manganese, 15 per cent iron, and 8 per cent silica.

Walter H. Denison, who shipped the largest amount of both classes of ore, operates in the Batesville-Cushman district. In addition to ore from his own property, Denison shipped a considerable tonnage purchased from independent operators.

The Arkansas Manganese Ore Co. shipped a few cars of manganese ore averaging (dried) 43.3 per cent manganese, 6.47 per cent iron, and 9.3 per cent silica. The properties of this company were idle during most of the year.

A. B. Reither shipped 1,039 long tons of manganese ore averaging (dried) 48.72 per cent manganese from the Aydelotte Mine near Cushman.

A small carload of manganese ore containing (dried) 51.74 per cent manganese was shipped from a property on the line between Pike and Montgomery Counties near Caddo Gap.

CALIFORNIA

Shipments of manganese ore from California amounted to 40 long tons in 1931 compared with 162 tons in 1930. The Owl Holes Mine in San Bernardino County was the only shipper in 1931.

COLORADO

No shipments of manganese ore were made from Colorado in 1931; but 3,685 long tons of ferruginous manganese ore, valued at $21,880, were shipped from the Leadville district compared with 19,730 tons, valued at $109,796, in 1930. The 1931 shipments averaged 24 per cent manganese, 20.7 per cent iron, 7.83 per cent silica, and 16.3 per cent moisture. Shipments from this property to the iron furnaces in Colorado ceased during April, 1931, because the zinc content was over 1 per cent.

GEORGIA

Shipments of manganese ore from Georgia amounted to 6,491 long tons in 1931, a large decrease from 18,897 tons shipped in 1930. During 1931 the Brunswick Terminal & Railway Securities Co. and the American Minerals Corporation, holding companies of the Georgia Manganese & Iron Co., formed the Manganese Corporation of America, which acquired at foreclosure sale the properties of the Georgia Manganese & Iron Co. in Bartow County near Aubrey. It was also reported that the Manganese Corporation of America had optioned 5,000 acres of land owned by the Etowah Development Co. in Bartow County where tests for manganese will be made. The bulk of the shipments in 1931 came from the Manganese Corporation of America and averaged (dried) about 38 per cent manganese. Other shippers of manganese ore from Georgia were J. T. Thomasson and H. C. Simpson; both shipped from mines in Bartow County.

There were also shipped from Georgia 11,652 long tons of ferruginous manganese ore in 1931 compared with 12,009 tons in 1930. Virtually all the material in 1931 was shipped by the Manganese Corporation of America and carried (dried) slightly less than 31 per cent manganese. The only other shipper was F. D. Smith who supplied one car of ore from Bartow County.

IDAHO

No shipments of manganese ore were made from Idaho in 1931. Shipments of ferruginous manganese ore amounted to 578 long tons in 1931 compared with 1,450 tons in 1930; all the ore shipped in 1931 came from the Idaho Manganese Mine of the Idaho Manganese Mining Co. and averaged (natural) 33 per cent manganese.

MICHIGAN

Shipments of ferruginous manganese ore from Michigan in 1931 totaled 2,217 long tons. They were made by the Castile Mining Co., from the Asteroid-Eureka Mine in Gogebic County, and averaged (dried) 11.85 per cent manganese, 44.8 per cent iron, and 8.1 per cent silica. Although 10,161 long tons of manganiferous iron ore were mined by the Hanna Iron Ore Co. at the Rogers Mine in Iron County in 1931, there were no shipments.

MINNESOTA

Shipments of ferruginous manganese ore from Minnesota amounted to 26,567 long tons, valued at $162,988, in 1931 compared with 4,698 tons, valued at $17,837, in 1930. A large part of such shipments came from the Merritt Mine, on the Cuyuna range, where the Manganiferous Iron Co. has built a mill with a daily capacity of 500 tons to treat the black ferruginous manganese ores of this district. The flow sheet (which was worked out in conjunction with the Mississippi Valley Experiment Station of the Bureau of Mines) consists of crushing the ore to 5-mesh, classifying, and tabling; the slimes from the tables are sent to the flotation unit for additional recovery of the fine iron and manganese minerals. The concentrates have a tenor of about 17 per cent manganese, 38 per cent iron, 11 per cent silica, and 5 per cent moisture. The 10 concentrating tables have demonstrated the capacity of tables for treating ores of this type. Large tonnages of this black ferruginous manganese ore, formerly considered valueless because of its high silica content, are available on the Cuyuna range. The Cuyuna Mille Lacs (Louise) and the Hillcrest Mines of the Manganiferous Iron Co. also shipped ore of this grade.

Minnesota also shipped 217,352 long tons of manganiferous iron ore, valued at $570,800, in 1931 compared with 693,546 tons, valued at $1,794,334, in 1930. The ore averaged (natural) 7.54 per cent manganese and 38.12 per cent iron in 1931. It came from the Milford Mine (Amherst Mining Co.), Alstead, Hillcrest, Louise, and Merritt Mines (Manganiferous Iron Co.), Sagamore Mine (Sagamore Ore Mining Co.), and Wearne Mine (Inland Steel Co.), all on the Cuyuna range.

The following table shows the shipments of ferruginous manganese and manganiferous iron ores from the Cuyuna range, by mines, from 1927 to 1931.

Ferruginous manganese and manganiferous iron ore shipped from the Cuyuna district, Minnesota, 1927–1931, in long tons

Mine	Ore containing 10 to 35 per cent manganese					Ore containing 5 to 10 per cent manganese				
	1927	1928	1929	1930	1931	1927	1928	1929	1930	1931
Alstead	------	------	------	------	------	------	------	------	------	49,378
Cuyuna Mille Lacs (Louise)	6,276	[1] 3,487	4,129	2,079	5,919	218,791	205,103	110,308	91,948	21,326
Evergreen	------	------	------	------	------	------	7,881	74,254	------	------
Hillcrest	------	------	------	------	1,876	------	------	105,942	151,978	211
Mahnomen	------	------	------	------	------	374,307	340,630	218,887	193,879	------
Martin	------	------	------	------	------	------	------	------	1,009	------
Merritt	------	------	1,292	2,619	18,772	------	------	4,400	------	1,056
Milford (Ida Mae)	------	------	------	------	------	149,034	161,432	218,928	98,209	77,244
Sagamore	------	------	------	------	------	192,467	309,968	271,701	130,172	34,376
Wearne	------	------	------	------	------	------	------	------	26,351	33,761
	6,276	3,487	5,421	4,698	26,567	934,599	1,025,014	1,004,420	693,546	217,352

[1] Includes ore from the Mangan Mine in 1928.

MONTANA

Shipments of metallurgical manganese ore from Montana amounted to 17,088 long tons in 1931 compared with 22,731 tons in 1930. The shipments consisted of 16,335 tons of rhodochrosite from the Emma Mine of the Anaconda Copper Mining Co. and 753 tons of sinter from the Domestic Manganese & Development Co., which uses the Emma rhodochrosite as its raw material. The rhodochrosite shipped in 1931 contained (dried) 35.3 per cent manganese, 2.3 per cent iron, and 11.5 per cent silica, and the sinter contained 58.8 per cent manganese.

The plant of the Domestic Manganese & Development Co. was shut down in 1931, except for a small test run in December when natural gas supplanted coal as fuel. The gas was brought into the Butte district during the year from northern Montana. It is reported that the gas, which is cheaper than coal, worked satisfactorily and prevented the formation of hard incrustations on the inside of the kiln, as when coal was used.

Sinter made from rhodochrosite roasted by Domestic Manganese & Development Co., Butte, Mont., 1927–1931

Year	Rhodochrosite roasted		Sinter made		Manganese recovered from rhodochrosite (per cent)
	Long tons	Manganese (per cent)	Long tons	Manganese (per cent)	
1927	6,430	37.28	4,114	55.90	96
1928	18,595	36.63	11,118	56.45	92
1929	47,025	37.60	29,041	57.8	95
1930	23,938	37.9	14,595	57.6	93
1931	1,226	38.8	753	58.8	93
	97,214	37.48	59,621	57.38	94

Shipments of battery ore, all from the Philipsburg district, amounted to 7,802 long tons in 1931 compared with 11,451 tons in 1930. The battery ore produced in Montana comes from the mills of the Trout Mining Co. and the Moorlight Mining Co. at Philipsburg, where manganese dioxide is concentrated magnetically from ores mined in the district. The Trout Mining Co. mines its ore at its Trout mine, and the Moorlight Mining Co. mills ore from various leasers in the district.

Shipments of manganese ore from Montana for miscellaneous purposes—manufacture of chemicals, electrolytic zinc refining, and paint manufacture—in 1931 came from both Butte and Philipsburg and amounted to 922 long tons.

In addition, a total of 14,311 long tons of ore containing (dried) 23.03 per cent manganese was shipped in 1931, compared with 11,875 tons in 1930, from the Philipsburg district where it is produced as a tailing in the magnetic treatment of ores to produce a high-grade product for the battery trade. It is shipped to the Columbia Steel Co. at Provo, Utah, where it is made part of the blast-furnace burden. The material shipped in 1931 came from the tailings piles of the old Philipsburg Mining Co. and the Trout Mining Co.

NEW MEXICO

Shipments of manganese ore from New Mexico amounted to 1,072 long tons in 1931 compared with 2,574 tons in 1930. The Manganese Valley Mines (Inc.), with mines in the Little Florida Mountains east of Deming, furnished all the 1931 shipments but did not operate during the latter half of the year. The ore contained (dried) 44.48 per cent manganese.

SOUTH DAKOTA

No manganese-bearing ores were shipped from South Dakota in 1931. It was reported that the General Manganese Corporation is building a concentrator with a daily capacity of 50 tons to treat material from the Chamberlain deposits. It was also reported that the corporation is planning a refinery at Sioux Falls.

TENNESSEE

Shipments of manganese ore from Tennessee in 1931 amounted to 70 long tons, all from the Red Hill Mine in Bradley County.

TEXAS

Shipments of manganese ore from Texas amounted to 155 long tons in 1931 compared with 247 tons in 1930. Joe Darnell shipped 80 tons of ore averaging (natural) 47 per cent manganese from a property in Jeff Davis County, and Thomas Venditto shipped 75 tons averaging (dried) 47.35 per cent manganese from the Spiller Mine in Mason County.

UTAH

No manganese ore was shipped from Utah in 1931. Shipments of ferruginous manganese ore amounted to 1,501 long tons, valued at $16,601, in 1931 compared with 10,972 tons, valued at $91,742 in 1930. In 1931 the ore averaged (dried) about 35 per cent manganese and 5 per cent iron. C. W. Jenkins was the largest shipper, his output coming from the Black Jack, Tip Top, and Benmore Mines in Utah, Juab, and Tooele Counties, respectively. The properties closed in June as there was no further market for the ore.

VIRGINIA

Shipments of metallurgical manganese ore from Virginia amounted to 901 long tons, valued at $16,650, in 1931 compared with 3,055 tons, valued at $56,791, in 1930. The largest shipper was the Hy-Grade Manganese Production & Sales Corporation, which operates the Mineral Ridge Mine in Shenandoah County; shipments from this property averaged (dried) 45 per cent manganese. The Eureka Mine in Page County shipped several cars of ore averaging (dried) 45 per cent manganese, 2.6 per cent iron, and 14 per cent silica. Two other mines shipped small amounts.

Shipments of battery-grade ore amounted to 150 long tons and came from the Hy-Grade Manganese Production & Sales Corporation.

Shipments of manganese ore for miscellaneous uses amounted to 454 long tons in 1931 and came from three producers, including the Stange Mine in Bland County where development work was continued and high-tension power lines and transformers were installed.

There were no shipments of ferruginous manganese ore or manganiferous iron ore from Virginia in 1931.

WEST VIRGINIA

The Monroe Manganese Mining Corporation shipped a carload of manganese ore averaging (dried) 39 per cent manganese from its property in Monroe County.

PUERTO RICO

The manganese ore produced in Puerto Rico comes from the mine of the Atlantic Ore Co. about 3 miles from Juana Diaz. The ore bodies consist of psilomelane and pyrolusite and occur near the surface as small irregularly shaped lenses in crystalline limestone. Mining methods are crude. Peons carry the ore to a bin whence it is transported by cableway to a mill equipped with two jigs. From the mill the washed ore is transported in wheelbarrows to the crusher, where it is crushed according to buyers' requirements. The concentrates, which are suitable for battery purposes, are shipped to consumers in the eastern part of the United States. During 1931, 2,374 long tons were shipped to the United States. Puerto Rican production of manganese ore is not included in the figures given in this report for United States production. Shipments of manganese ore from Puerto Rico to the United States in the past five years follow.

Manganese ore shipped from Puerto Rico to the United States, 1927–1931

Year	Long tons	Value
1927	1,624	$41,764
1928	1,523	56,616
1929	2,316	83,646
1930	2,536	$84,691
1931	2,374	87,356

PRODUCERS OF DOMESTIC MANGANESE ORE

The following list comprises producers and shippers of domestic manganese ore (35 per cent or more manganese) in 1931.

Producers and shippers of domestic manganese ore in 1931

Arizona: William M. Ebner, 6637 Franklin Avenue, Hollywood, Calif.
Arkansas:
  Arkansas Manganese Ore Co., Batesville.
  Walter H. Denison, Cushman.
  Hopper and Roller, Caddo Gap.
  A. B. Reither, Cushman.
California: J. W. Wood, 247 Eureka Avenue, San Bernardino.
Georgia:
  Manganese Corporation of America, White.
  H. C. Simpson, Cartersville.
  J. T. Thomasson, Chattanooga, Tenn.
Montana:
  Anaconda Copper Mining Co., Butte.
  Domestic Manganese & Development Co., Butte.
  Moorlight Mining Co., Philipsburg.
  Trout Mining Co., Philipsburg.
New Mexico: Manganese Valley Mines (Inc.), Deming.
Tennessee: J. T. Thomasson, Chattanooga.
Texas:
  Joe Darnell, Denton.
  Thomas Venditto, 279 Nelson Avenue, Great Kills, N. Y.
Virginia:
  Bruce & Horne Manganese Co., Crandon.
  O. W. Danner, Crandon.
  John Hall, Evington.
  Huff, Andrews & Thomas, Bluefield, W. Va.
  Hy-Grade Manganese Production & Sales Corporation, Woodstock.
  Stanley Manganese Mines, 1817 Thirty-seventh Street NW., Washington, D. C.
West Virginia: Monroe Manganese Mining Corporation, Clifton Forge, Va.

PRICE OF MANGANESE ORE

Prices for manganese ore according to grade and origin are quoted by various trade journals and (except for battery ore) are on a per-unit basis, the unit being 1 per cent of a long ton or 22.4 pounds of metallic manganese. Prices for battery-grade ore are quoted on a per-ton basis with a minimum requirement of manganese dioxide.

According to Engineering and Mining Journal the trend of prices for imported metallurgical-grade ore was as follows during 1931. The prices are given per long-ton unit of manganese c. i. f. North Atlantic ports, exclusive of duty.

Brazilian ore containing 46 to 48 per cent manganese was quoted at 25 cents at the beginning of the year but dropped to 23 cents in May, where it remained for the rest of the year.

Indian ore containing 48 to 50 per cent manganese was quoted at 27 to 28 cents at the beginning of the year but dropped in January to 26 to 27 cents and declined further in July to 25 to 26 cents, at which price it was quoted for the rest of the year.

Caucasian (Russian) ore containing 52 to 55 per cent manganese was quoted at 27 to 28 cents at the beginning of the year, but dropped to 25 to 26 cents in January. The price was 25 to 27 cents for the rest of the year.

There were no quotations on Cuban ore during 1931.

Prices of Chilean ore containing a minimum of 47 per cent manganese opened the year at 30½ cents but declined to 29 cents in February. No lower quotations were published during the year.

Prices on South African ore containing 52 to 54 per cent manganese were 27 to 28 cents at the beginning of the year, were cut to 24 to 26 cents in January, declined further to 23 to 25 cents in September, and were unchanged for the rest of the year. Lower-grade (44 to 46 per cent manganese) South African ore was quoted at 23½ cents early in the year but dropped to 21½ cents in September and remained at that figure for the rest of the year.

According to Engineering and Mining Journal the trend of prices per long ton for chemical (battery) ores was as follows during 1931. Domestic chemical ores containing 70 to 72 per cent manganese dioxide were quoted at $40 to $60 a ton during the year. Imported chemical ores, containing a minimum of 80 per cent manganese dioxide, were quoted at $60 at the beginning of the year, but the price dropped to $50 per ton in carload lots in September; the price was $60 per ton in barrels in September.

IMPORTS OF MANGANESE ORE

Total imports of manganese ore in 1931 amounted to 502,518 long tons, containing 245,910 tons of manganese and valued at $5,104,590, compared with 585,568 tons, containing 278,070 tons of manganese and valued at $6,476,802, in 1930. The decrease of 14 per cent in quantity of ore was caused by curtailed activities in the steel industry, the main consumer of manganese. The following table shows the imports of manganese ore into the United States for the past five years.

Manganese ore imported into the United States, 1927–1931

[General imports]

Year	Long tons	Value	Year	Long tons	Value
1927	622, 067	$8, 487, 016	1930	585, 568	$6, 476, 802
1928	427, 708	5, 395, 949	1931	502, 518	5, 104, 590
1929	664, 269	8, 450, 818			

Of the manganese ore imported in 1931, 39 per cent came from Russia, 27 per cent from Brazil, 17 per cent from Gold Coast, and 10 per cent from India; these four countries accounted for 93 per cent of the total. Large decreases in imports are noted from the principal exporting nations; the largest decrease (51,121 tons or 28 per cent) was in imports from Brazil. Russian imports declined about 30,000 tons (13 per cent). Imports from Gold Coast held up fairly well, the decline in 1931 being only 6 per cent. Imports from Canada, Cuba, Java, and the United Kingdom, all minor sources, showed increases; those from Canada were probably transshipments from some other source. Imports from the Union of South Africa, a new source, amounted to 5,002 tons. The following table shows the imports of manganese ore into the United States, by countries, from 1929 to 1931.

Manganese ore imported into the United States, 1929–1931, by countries

[General imports]

Country	Manganese ore (long tons)			Manganese content (long tons)			Value		
	1929	1930	1931	1929	1930	1931	1929	1930	1931
Brazil	216, 535	185, 048	133, 927	93, 961	79, 849	59, 174	$1,427,160	$1,484,039	$947, 549
Canada	4, 804	15, 998	18, 832	2, 646	7, 706	9, 958	102, 975	343, 437	251, 679
Chile	2, 000	3, 485	1, 748	884	1, 544	822	21, 000	33, 488	17, 484
Cuba	2, 667	2, 071	3, 804	1, 959	899	1, 199	32, 654	32, 317	19, 891
Egypt	101			58			4, 762		
Germany	1, 137	66	30	569	33	17	34, 148	3, 583	1, 951
Gold Coast	33, 593	93, 142	87, 439	16, 058	44, 892	43, 908	366, 130	1, 253, 742	1, 228, 707
Greece		9			4			487	
India (British)	72, 940	58, 150	47, 850	37, 479	29, 989	24, 646	968, 443	839, 621	550, 515
Italy	71			60			8, 933		
Java and Madura	1, 000	1, 602	1, 754	571	917	972	25, 093	30, 906	34, 961
Soviet Russia in Europe	329, 336	225, 888	195, 834	169, 121	112, 174	99, 335	5, 452, 366	2, 445, 871	1, 896, 538
Union of South Africa			5, 002			2, 601			67, 627
United Kingdom	85	109	6, 298	49	63	3, 278	7, 154	9, 311	87, 688
	664, 269	585, 568	502, 518	323, 415	278, 070	245, 910	8, 450, 818	6, 476, 802	5, 104, 590

Stocks of manganese ore in bonded warehouses increased materially during 1931 and at the end of the year amounted to 613,814 long tons containing 300,410 tons of manganese metal, compared with 413,216 tons of ore containing 201,550 tons of manganese metal at the end of 1930.

TARIFF

The status of manganese ore in the tariff bill of 1930 is given on page 315 of the chapter of this series for 1930. The tariff was not changed in 1931.

CONSUMPTION OF MANGANIFEROUS RAW MATERIALS

The indicated consumption of manganiferous raw materials in the United States in 1930 and 1931 is shown in the following table. The table does not take into account the difference in consumers' stocks at the beginning and end of the year. As such stocks are largely imported ore and the import figure used in the table is that for "imports for consumption," it is thought that the change in stocks would not be great because the manganese ore may be kept in bond until withdrawn for consumption. The duty is then paid and the ore is reported as "imports for consumption."

Indicated consumption of manganiferous raw materials in the United States, 1930 and 1931

	Ore containing 35 per cent or more manganese		Ore and residuum containing 10 to 35 per cent manganese		Ore containing 5 to 10 per cent manganese	
	Long tons	Manganese content (per cent)	Long tons	Manganese content (per cent)	Long tons	Manganese content (per cent)
1930						
Domestic shipments	[1][2] 69,571	[3] 45	190,477	17	707,973	7.5
Imports for consumption	454,625	48	[4] 111,000	23	[2][4] 44,000	[2] 6.8
Total available for consumption	[2] 524,196	47	301,477	19	[2] 751,973	7.5
1931						
Domestic shipments	[1] 41,616	[3] 41	161,052	16	217,352	7.5
Imports for consumption	293,137	48	[4] 34,000	25	[4] 65,000	6.8
Total available for consumption	334,753	47	195,052	17	282,352	7.4

[1] Includes shipments from Puerto Rico.
[2] Revised figures.
[3] Partly estimated.
[4] Estimated.

Besides the material shown in the foregoing table 612,000 long tons of iron ore containing 2 to 5 per cent manganese were presumably used in the manufacture of manganiferous pig iron in 1931 compared with 997,000 tons in 1930.

The sources of the imported ore containing more than 35 per cent manganese are discussed in the sections of this chapter on imports and ferrous-metallurgical industry.

The sources of the imported ores containing 10 to 35 per cent manganese and 5 to 10 per cent manganese, consumed in the United States during the past five years, are shown in the following tables.

Foreign ferruginous manganese ore consumed in the United States, 1927–1931, in long tons

Source of ore	1927	1928	1929	1930	1931
Australia		13,314	35,536	41,773	7,949
Brazil	875	20,353	67,638	61,872	7,034
Canada				919	4,473
Cuba					2,438
India			6,808	4,903	3,259
Palestine		1,687	1,943	979	276
Sinai Peninsula			3,739	72	
Undistributed					8,623
	875	35,354	115,664	110,518	34,052

Foreign manganiferous iron ore consumed in the United States, 1927–1931, in long tons

Source of ore	1927	1928	1929	1930	1931
Africa	24,144	65,621	46,686	29,546	5,962
Australia				1,804	59,421
Spain	54,731	15,617	262	12,520	
Sweden			3,557		
Undistributed	42,402				
	121,277	81,238	50,505	43,870	65,383

The manufacturing industries in the United States that consume manganese ore fall into three main groups: The ferrous-metallurgical industry, the battery industry, and miscellaneous industries. The first group consumes by far the largest quantity, whereas the third group has little importance when the total consumption of manganese ore is considered but has significance to the small producers of specialty ores.

The following lists give some consumers of domestic manganese ores.

Consumers of domestic metallurgical manganese ore

Buckeye Steel Castings Co., Columbus, Ohio.
Colorado Fuel & Iron Co., Pueblo, Colo.
Columbia Steel Co., Ironton, Utah, and Torrance, Calif.
Lavino Furnace Co., Reusens, Va., and Marietta and Sheridan, Pa.
Ohio Ferro-Alloys Corporation, Philo, Ohio.
Pacific Coast Steel Corporation, Seattle, Wash.
Republic Steel Corporation, Birmingham, Ala.
Tennessee Coal, Iron & Railroad Co., Bessemer, Ala.
United States Pipe & Foundry Co., Chattanooga, Tenn.
United States Steel Corporation, Etna and Pittsburgh, Pa.

Consumers of domestic battery and miscellaneous manganese ore

Bond Electric Co., Jersey City, N. J.
Bright Star Battery Co., Hoboken, N. J.
Bunker Hill & Sullivan Mining & Smelting Co., Bradley, Idaho.
Burgess Battery Co., Freeport, Ill., and Niagara Falls, Ontario, Canada.
Carbon Products Co., Lancaster, Pa.
Carus Chemical Co., La Salle and Joliet, Ill.
City of Brainerd, Brainerd, Minn.
Consolidated Mining & Smelting Co., Trail, British Columbia.
Dominion Dry Battery Co., Toronto, Canada.
Evans-Wallower Zinc Co., East St. Louis, Ill.
Folsom Battery Co., Chicago, Ill.
French Battery Co., Madison, Wis.
Hudson Bay Mining Co., Flin Flon, Manitoba.
E. J. Lavino Co., Plymouth Meeting, Pa.
Marathon Battery Co., Wausau, Wis.
National Carbon Co., Cleveland and Fremont, Ohio, and San Francisco, Calif.
National Paint & Manganese Co., Lynchburg, Va.
Pacific Coast Borax Co., Los Angeles, Calif.
St. Louis Sulphur & Chemical Co., St. Louis, Mo.
Sullivan Mining Co., Silver King, Idaho.
U. S. Electric Co., New York, N. Y.

FERROUS-METALLURGICAL INDUSTRY

The following table shows critical data on manganese alloys imported into and produced in the United States.

Chief manganese alloys imported into and made from domestic and imported ores in the United States, 1927–1931, in long tons

	1927		1928		1929		1930		1931	
	Alloy	Manganese	Alloy	Manganese	Alloy	Manganese	Alloy	Manganese	Alloy	Manganese
Ferromanganese:										
Imported	[1] 45, 500	[1] 36, 400	[1] 61, 055	[1] 48, 844	[1] 71, 211	[1] 56, 969	55, 046	44, 037	24, 664	19, 836
Domestic production	294, 991	232, 900	319, 770	251, 400	339, 205	269, 000	274, 830	216, 000	166, 937	131, 200
From domestic ore [2]	10, 037	7, 472	18, 850	14, 036	16, 428	13, 056	18, 544	14, 142	5, 578	4, 141
From imported ore [2]	284, 954	225, 428	300, 920	237, 364	322, 777	255, 944	256, 286	201, 858	161, 359	127, 059
Total	340, 491	269, 300	380, 825	300, 244	410, 416	325, 969	329, 876	260, 037	191, 601	151, 036
Ratio (per cent) of manganese in ferromanganese of domestic origin to total manganese in ferromanganese made and imported		2. 77		4. 67		4. 01		5. 44		2. 74
Number of plants making ferromanganese	7		7		8		8		5	
Spiegeleisen:										
Imported	7, 529	1, 506	5, 260	1, 052	13, 828	2, 766	13, 406	2, 681	9, 482	1, 896
Domestic production	100, 314	20, 400	99, 517	19, 200	137, 143	27, 344	87, 059	17, 412	[3] 67, 800	[4] 13, 560
From domestic ore [2]	97, 337	19, 834	99, 517	19, 200	101, 102	20, 041	57, 493	11, 499	(5)	(5)
From imported ore [2]	2, 977	566			36, 041	7, 303	29, 566	5, 913	(5)	(5)
Total	107, 843	21, 906	104, 777	20, 252	150, 971	30, 110	100, 465	20, 093	77, 282	15, 456
Ratio (per cent) of manganese in spiegeleisen of domestic origin to total manganese in spiegeleisen made and imported		90. 54		94. 81		66. 56		57. 23		(5)
Number of plants making spiegeleisen	5		4		5		5		2	
Total available supply of metallic manganese as alloys		291, 206		320, 496		356, 079		280, 130		166, 492
Percentage of available supply of manganese in—										
Ferromanganese and spiegeleisen imported		13. 02		15. 57		16. 78		16. 68		13. 05
Ferromanganese made from imported ore		77. 41		74. 06		71. 88		72. 06		76. 32
Spiegeleisen made from imported ore		. 19				2. 05		2. 11		(5)
Ferromanganese made from domestic ore		2. 57		4. 38		3. 66		5. 05		2. 49
Spiegeleisen made from domestic ore		6. 81		5. 99		5. 63		4. 10		(5)
Ferromanganese and spiegeleisen made from domestic ore		9. 38		10. 37		9. 29		9. 15		(5)
Spiegeleisen made and imported		7. 52		6. 32		8. 46		7. 17		9. 28
Total open-hearth and Bessemer steel	44, 260, 062		50, 734, 151		55, 475, 397		40, 084, 631		25, 533, 012	

[1] Includes small quantities of other manganese alloys.
[2] Partly estimated.
[3] Steel, Manganese Ore and Alloy Statistics: Vol. 90, No. 1, Jan. 4, 1932, p. 198.
[4] Estimated.
[5] Bureau of Mines not at liberty to publish figures.

FERROMANGANESE

In 1931 the United States produced 166,937 long tons of ferromanganese, compared with 274,830 tons in 1930 and with an average of 309,370 tons for the period 1926–1930. The record year for ferromanganese output was 1929 when 339,205 tons were produced. The ferromanganese produced in 1931 contained 131,200 tons of manganese (metal), an average of 78.59 per cent. The following table shows the production of ferromanganese during the past five years and the metalliferous materials consumed in its manufacture.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1927–1931

Year	Ferromanganese produced			Materials consumed (long tons)				Manganese ore used per ton of ferromanganese made (long tons)
	Long tons	Manganese contained		Manganese ore		Iron and manganiferous iron ores	Cinder, scale, and scrap	
		Per cent	Long tons	Foreign	Domestic			
1927	294,991	78.95	232,900	[1] 564,725	25,298	12,735	8,570	2.000
1928	319,770	78.62	251,400	566,859	37,827	23,159	8,395	1.891
1929	339,205	79.30	269,000	614,763	27,558	47,735	7,811	1.894
1930	274,830	78.59	216,000	459,478	32,969	51,039	9,712	1.792
1931	166,937	78.59	131,200	287,973	12,277	19,214	3,405	1.799

[1] Includes Puerto Rican ore.

The production of ferromanganese in 1931 used 287,973 long tons of foreign manganese ore, 12,277 tons of domestic manganese ore, 10,945 tons of foreign ferruginous manganese ore, 8,269 tons of domestic iron ore, and 3,405 tons of cinder, scale, and scrap. Of the foreign manganese ore used in the manufacture of ferromanganese in 1931, Russia supplied the largest part (168,580 tons) and Brazil the next largest (62,630 tons). These two countries accounted for 80 per cent of the imported manganese ore used in the manufacture of ferromanganese and 77 per cent of the total manganese ore so consumed. The following table shows the foreign manganese ore, by countries of origin, consumed in the manufacture of ferromanganese from 1927 to 1931.

Foreign manganese ore used in manufacture of ferromanganese in the United States, 1927–1931, in long tons

Source of ore	1927	1928	1929	1930	1931
Africa	41,470	25,039	28,592	62,913	26,133
Brazil	245,485	218,181	228,737	138,757	62,630
Chile	3,746	5,118	1,187	1,705	4,363
Cuba	9,408	14,280	2,050	------	------
India	78,548	96,232	86,547	44,667	26,267
Russia	184,402	208,009	267,600	211,436	168,580
Turkey	------	------	50	------	------
	563,059	566,859	614,763	459,478	287,973

The quantity of manganese ore used per ton of ferromanganese made decreased steadily from 2.246 tons in 1922 to 1.891 tons in 1928 and has since varied slightly, amounting to 1.799 tons in 1931. Domestic manganese ore represented 4.1 per cent of the total manganese ore used in the manufacture of ferromanganese in 1931.

Of the foreign ferruginous manganese ore used in the manufacture of ferromanganese in 1931, Brazil supplied 7,034 long tons, India 3,259 tons, and Australia 652 tons.

Ferromanganese was manufactured in the following plants in 1931.

Bethlehem Steel Co., Johnstown, Pa.
Lavino Furnace Co., Reusens, Va.
Pittsburgh Metallurgical Co., Niagara Falls, N. Y.
Tennessee Coal, Iron & Railroad Co., Ensley, Ala.
United States Steel Corporation, Pittsburgh, Pa.

Shipments of ferromanganese totaled 159,168 long tons, valued at $12,999,329, in 1931 compared with 273,640 tons, valued at $25,865,783, in 1930. The trend of shipments during the past five years has been as follows:

Ferromanganese shipped from furnaces in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	291,056	$27,243,489	1930	273,640	$25,865,783
1928	310,122	29,199,990	1931	159,168	12,999,329
1929	334,162	33,184,012			

Although there is a slight export trade in ferromanganese the quantity manufactured in the United States is supplemented by imports from abroad. Ferromanganese imported for consumption in 1931 included 24,234 long tons containing more than 1 per cent carbon and 430 tons containing less than 1 per cent carbon. Imports of ferromanganese for consumption in the United States and exports of ferromanganese and spiegeleisen, 1927–1931, are shown in the following table.

Ferromanganese imported into and exported from the United States, 1927–1931

Year	Imports for consumption [1]		Exports [2]	
	Manganese content (long tons)	Value	Gross weight (long tons)	Value
1927	[1] 36,400	[1] $3,553,465	1,641	$61,793
1928	[1] 48,844	[1] 4,899,374	9,440	232,990
1929	[1] 56,969	[1] 6,126,056	1,574	59,036
1930	[3] 44,037	[3] 4,021,040	6,189	145,629
1931	[3] 19,836	[3] 1,751,646	1,306	38,506

[1] Figures for 1927 to 1929 include small quantities of other manganese alloys.
[2] Include spiegeleisen; not separately classified.
[3] Excludes other manganese alloys as follows: 1930, 964 tons, $107,025; 1931, 431 tons, $44,929.

The largest imports of ferromanganese in 1931 were from Canada and the next largest from the United Kingdom. Imports of ferromanganese are also noted from Yugoslavia in 1931. The following table shows the sources from which ferromanganese was imported in 1930 and 1931.

Ferromanganese[1] *imported into the United States, 1930 and 1931, by countries*

[General imports]

Country	1930		1931	
	Manganese content (long tons)	Value	Manganese content (long tons)	Value
Canada	16, 216	$2, 016, 293	8, 331	$865, 891
France	170	30, 320	180	21, 970
Germany	324	24, 279	410	20, 611
Italy	1, 023	159, 771	590	82, 312
Norway	7, 458	789, 662	2, 712	285, 963
United Kingdom	13, 261	971, 195	5, 105	315, 842
Yugoslavia and Albania			436	14, 580
	38, 452	3, 991, 520	17, 764	1, 607, 169

[1] Includes small quantities of other manganese alloys.

Ports into which imported ferromanganese entered in 1930 and 1931 were as follows:

Manganese content of ferromanganese[1] *imported into the United States, 1930 and 1931, by ports of entry, in long tons*

[General imports]

Port of entry	1930	1931
Buffalo	10, 522	4, 163
Galveston	58	24
Los Angeles	1, 354	474
Maryland	12, 865	5, 251
Michigan	3, 701	2, 601
New Orleans	3, 141	1, 175
New York	1, 174	865
Ohio	2, 088	1, 716
Oregon	78	39
Philadelphia	1, 045	745
San Francisco	2, 104	690
Washington (State)	322	21
	38, 452	17, 764

[1] Includes small quantities of other manganese alloys.

Stocks of ferromanganese in bonded warehouses amounted to 6,745 long tons containing 6,017 tons of manganese metal at the end of 1931 compared with 9,793 tons containing 8,747 tons of manganese at the end of 1930.

TARIFF ON FERROMANGANESE

The status of ferromanganese in the tariff bill of 1930 is given on page 321 of the chapter of this series for 1930. The tariff was not changed in 1931.

PRICE OF FERROMANGANESE

The price of ferromanganese in 1931, although somewhat lower than in preceding years, was fairly steady at $89.79 a long ton of 80 per cent alloy, delivered at Pittsburgh, until near the close of the year when it was cut $10 a ton; the quotation at the end of the year was $79.79. The trend of prices during the past five years is shown in the following table.

Prices per long ton of ferromanganese in the United States, 1927–1931 [1]

[80 per cent—delivered at Pittsburgh]

Month	1927	1928	1929	1930	1931
January	$104.79	$104.79	$109.79	$104.79	$89.79
February	104.79	104.79	109.79	103.79	89.79
March	104.79	104.79	109.79	103.79	89.79
April	104.79	104.79	109.79	103.79	89.79
May	98.54	108.19	109.79	103.79	89.79
June	94.79	109.79	109.79	103.79	89.79
July	94.79	109.79	109.79	103.79	89.79
August	94.79	109.79	109.79	103.79	89.79
September	94.79	109.79	109.79	103.79	89.79
October	94.79	109.79	109.79	103.79	89.79
November	94.79	109.79	109.79	103.79	89.79
December	103.42	109.79	104.79	93.25	79.79

[1] Steel: Vol. 90, Jan. 4, 1932.

SPIEGELEISEN

The production of spiegeleisen in 1931 is estimated by Steel [4] at 67,800 long tons; the output in 1930, as reported to the Bureau of Mines, was 87,059 tons. In 1930 the spiegeleisen produced contained about 20 per cent manganese metal. The following table shows the production and shipments of spiegeleisen during the past five years.

Spiegeleisen produced and shipped in the United States, 1927–1931

Year	Produced (long tons)	Shipped from furnaces		Year	Produced (long tons)	Shipped from furnaces	
		Long tons	Value			Long tons	Value
1927	100,314	80,892	$1,986,188	1930	87,059	94,918	$2,469,861
1928	99,517	116,911	2,802,108	1931	[1] 67,800	55,327	1,313,068
1929	137,143	123,146	3,336,703				

[1] Steel, Manganese Ore and Alloy Statistics: Vol. 90, No. 1, Jan. 4, 1932, p. 198.

Spiegeleisen was manufactured in the following plants in 1931:

New Jersey Zinc Co., Palmerton, Pa.
Tennessee Coal, Iron & Railroad Co., Ensley, Ala.

Imports of spiegeleisen for consumption amounted to 9,482 long tons in 1931 compared with 13,406 tons in 1930. The trend of spiegeleisen imports in the past five years is shown in the following table.

Spiegeleisen imported for consumption in the United States, 1927–1931

Year	Long tons	Value	Year	Long tons	Value
1927	7,529	$220,979	1930	13,406	$381,197
1928	5,260	147,406	1931	9,482	247,788
1929	13,828	403,853			

Steel, Manganese Ore and Alloy Statistics: Vol. 90, No. 1, Jan. 4, 1932, p. 198.

The following table shows the trend in the price of spiegeleisen, by months, for the past five years.

Prices per long ton of spiegeleisen in the United States, 1927–1931 [1]

[20 per cent—at producers' furnaces]

Month	1927	1928	1929	1930	1931
January	$37.00	$32.00	$34.00	$34.00	$30.00
February	37.00	32.00	34.00	34.00	30.00
March	37.00	32.00	34.00	34.00	30.00
April	37.00	32.00	34.00	34.00	30.00
May	35.50	32.00	34.00	34.00	30.00
June	34.80	32.00	34.00	34.00	30.00
July	34.00	33.00	34.00	33.00	30.00
August	33.35	33.00	33.20	33.00	30.00
September	33.00	33.00	33.50	33.00	30.00
October	30.15	33.00	34.00	33.00	30.00
November	30.00	33.00	34.00	33.00	30.00
December	31.00	34.00	34.00	30.00	27.00

[1] Steel: Vol. 90, Jan. 4, 1932.

MANGANIFEROUS PIG IRON

There is a growing practice in the United States of making manganiferous pig iron containing 2 to 10 per cent manganese. Under existing technology sufficient manganiferous iron ores are added to the blast-furnace charge to give the desired manganese content in the pig. As the charge must be maintained at a uniform manganese content it is usually made by mixing various grades of manganiferous iron ores. The manganiferous pig iron is converted into steel in open-hearth furnaces. Part of the manganese contained in the pig iron carries some of the objectionable impurities into the slag; the remainder is carried over as an alloying metal in the final steel product. Considerable economy is therefore effected in the use of ferromanganese and spiegeleisen in the steel-making process.

Precise data on the consumption of manganiferous iron ores in the production of manganiferous pig are not available; however, in 1931, 217,352 long tons of ore containing 5 to 10 per cent manganese were shipped from domestic mines, and about 65,000 tons of imported material of this grade were consumed. Moreover, 612,000 tons of domestic iron ore containing 2 to 5 per cent manganese were shipped. Import figures for iron ores containing 2 to 5 per cent manganese are not available.

BATTERY INDUSTRY

Shipments of manganese ore by domestic producers to battery makers in 1931 amounted to 7,952 long tons, and shipments from Puerto Rico amounted to 2,374 tons. These figures indicate a consumption of 10,326 tons of domestic materials in battery manufacture. Imported manganese ore was also consumed in the battery industry, but no figures for such imports are available.

MISCELLANEOUS INDUSTRIES

Manganese ore is also consumed in the chemical, ceramic, and glass industries. Certain ores with peculiar physical or chemical properties are required for the manufacture of special articles in these industries. The domestic manganese ore shipped for these industries amounted to 1,416 long tons in 1931.

WORLD PRODUCTION

The following table shows, so far as statistics are available, the world production of manganese ores from 1927 to 1931, and the average manganese content. Most of the figures are from official statistics of the countries concerned, supplemented by data from semiofficial and other reliable sources.

Manganese ore produced in the principal countries, 1927–1931, in metric tons

[Prepared by L. M. Jones, of the Bureau of Mines]

Country [1]	Percentage of manganese	1927	1928	1929	1930	1931
North America:						
Canada (shipments)	----------	----------	349	273	497	176
Cuba	36–48	812	2,440	972	762	96
Mexico	40+	861	661	249	303	----------
United States—						
Continental (exclusive of fluxing ore)	35+	45,459	47,612	61,348	68,111	39,872
Puerto Rico [2]	35+	1,650	1,547	2,353	2,577	2,412
South America:						
Argentina [3]	----------	230	141	208	239	(4)
Brazil	38–50	273,494	359,651	316,172	206,831	147,349
Chile [2]	40–50	7,688	9,192	3,104	6,137	(4)
Europe:						
Bulgaria	30–45	7	----------	----------	----------	----------
Germany	30+	30	210	475	2,349	(4)
Great Britain	30+	1,048	239	----------	----------	----------
Greece	30+	8,283	1,080	1,600	6,310	(4)
Hungary	30	17,272	22,167	19,044	9,090	1,132
Italy	30–50	9,764	10,274	9,917	10,633	6,421
Portugal	38–60	491	----------	----------	----------	----------
Rumania	42	10,369	31,267	35,038	33,528	(4)
Russia [5]	41–48	843,850	673,398	1,183,880	1,444,166	(4)
Spain	29+	36,870	13,704	17,872	16,819	17,916
Sweden	45+	16,823	15,790	14,609	8,679	(4)
Yugoslavia	42–45	1,971	2,660	3,072	1,539	2,453
Asia:						
China [2]	50–55	46,350	43,332	41,881	54,854	22,051
Cyprus	----------	16	----------	----------	----------	----------
India—						
British	47–52	1,147,479	994,153	1,010,237	843,267	(4)
Portuguese	42–50+	[2] 2,414	6,654	5,092	5,476	3,547
Japan	50+	27,560	17,693	18,446	19,588	(4)
Netherland East Indies	45–56	18,503	24,452	20,892	16,690	14,541
Portuguese East Indies (Timor)	----------	----------	----------	3,300	----------	----------
Turkey	----------	11,398	61	151	900	1,000
Africa:						
Algeria [2]	----------	3,817	1,476	450	1,583	498
Egypt	30+	152,845	137,502	191,477	121,211	101,781
Gold Coast [2]	50+	409,658	348,755	465,282	453,773	226,889
Morocco (French)	40–50+	[2] 2,696	[2] 2,144	13,150	(6)	11,502
Northern Rhodesia	41–50	705	1,821	1,879	887	1,491
Tunisia	30–43	2,056	2,200	200	----------	(4)
Union of South Africa	40–60	1,300	----------	9,349	147,321	101,899
Oceania:						
Australia—						
New South Wales	----------	1,221	170	237	127	----------
Queensland	50±	246	----------	----------	----------	----------
South Australia	----------	----------	----------	----------	----------	13
Victoria	50±	15	----------	----------	----------	(4)
Western Australia [2]	47+	30	----------	81	----------	----------
New Caledonia [2]	----------	130	----------	----------	----------	(4)
New Zealand [2]	52+	5	----------	----------	2	(4)
	----------	3,105,000	2,773,000	3,452,000	3,496,000	(4)

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[1] In addition to the countries listed Belgium is reported to produce a small quantity of manganese, but statistics of output are not available. Czechoslovakia and France report a production of "manganese ore," but as it has been ascertained that the product so reported averages less than 30 per cent manganese and therefore would be considered ferruginous manganese ore under the classification used in this report the output has not been included in the table.

[2] Exports.

[3] Shipments by rail and river.

[4] Data not available.

[5] Year ended Sept. 30.

[6] Estimate included in total.

BRAZIL

Production of manganese ore in Brazil amounted to 145,021 long tons in 1931 compared with 203,564 tons in 1930, a decrease of 29 per cent, following a 35 per cent decrease from 1929 to 1930. Production held up fairly well during the first half of the year with the exception of February when transportation difficulties, a result of misinterpreted Government instructions, caused production to drop to 6,506 tons. Starting August 1, the Cia. Meridional de Mineração (United States Steel subsidiary) curtailed production for the remainder of the year.

Only four mining companies were active during the year—the Cia. Meridional de Mineração, Cia. Santa Mathilde, A. Thun & Cia. (Ltda.), and Carlos Wigg, who produced 974 tons in July. The production of each of these companies in 1930 and 1931 follows.

Manganese ore produced in Brazil, 1930 and 1931, by companies, in long tons

Company	1930	1931
Cia. Meridional de Mineração	138, 513	97, 300
Cia. Santa Mathilde	15, 444	17, 490
A. Thun & Cia. (Ltda.)	34, 063	29, 257
Carlos Wigg	15, 544	974
	203, 564	145, 021

The Cia. Meridional de Mineração output comes from the Morro da Mina Mine, the largest producing manganese mine in Brazil. The ore, which occurs in lenticular masses of great thickness, has the following analysis: [5]

	Per cent		Per cent
Manganese	50. 58	Silica	1. 51
Iron	7. 84	Hygroscopic water	2. 50
Phosphorus	. 07		

The total production of Brazil is exported, as there is no domestic demand for manganese ore. The exports from Brazil amounted to 154,440 long tons in 1931 compared with 189,088 tons in 1930, a decrease of 18 per cent. The exports are made chiefly by the subsidiary of an American company which ships entirely to its own principals. The continued decrease in activity in steel manufacture in the United States and the reduced prices for manganese were largely responsible for the curtailment of exports in 1931. During the first eight months the total shipments, except 1,600 tons sent to Belgium, went to the United States. Toward the end of the year, however, when exports to the United States decreased, several shipments were made to France and Belgium. Of the 154,440 tons exported the United States took 132,640 tons, France 17,440 tons, and Belgium 4,360 tons.

RUSSIA

The planned production of manganese ore for 1931 by the Union of Soviet Socialist Republics has been given as 960,000 metric tons compared with a planned production of 1,583,000 tons in 1930 and an actual production of 1,444,166 tons for the fiscal year ended September 30, 1930. The planned production for 1931 amounts to 66 per cent of the actual output in the fiscal year 1930 and is 39 per cent less than the planned production in 1930. The reduction has significance because of the rapidly increasing domestic consumption and because of the importance of manganese ore exports in obtaining gold for imports necessary to the industrialization envisioned by those in authority. Although the production figures for 1931 are not available it seems that the planned production in 1931 will be realized, as it calls for only two-thirds of the actual production in the fiscal year 1930. During 1929 and 1930 the U. S. S. R. was the largest producer and exporter of manganese ore in the world.

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[5] de Oliveira, E. P., Mineral Resources of Brazil: Serviço Geologico e Mineralogico do Brasil, Ministerio da Agricultura, Industria e Commercio, Rio de Janeiro, 1930, p. 21.

The chief source of Soviet manganese exports is the Chiaturi district, which is connected by standard-gage railroad to Poti, the Black Sea port. The Chiaturi ores are high in manganese and low in iron and sulphur. The Nikopol district, which exports some ore, is about 206 miles from Nikolaev, also on the Black Sea. The increasing output of the Nikopol district is being consumed in the domestic industry because it is produced near the consuming points. The ores exported from Russia in 1931 have been analyzed [6] as follows:

Analysis of manganese ores exported from Russia in 1931, in per cent

	Manganese	Silica	Phosphorus	Iron
Chiaturi:				
Washed ore	52	8	0.16	0.95
Ordinary ore	49.6	10.32	.17	1.15
Nikopol:				
First grade	48.43	8.84	.18	1.30
Second grade	42.75	14.46	.19	1.90

Although the production and exports from U. S. S. R. have been increasing, exports have not reached the record pre-war figure; and although production reached a new peak in the fiscal year ended September 30, 1930, its proportion to the total world production was less than in pre-war years. Exports of manganese ore from Russia amounted to 741,705 metric tons in the calendar year 1931 compared with 754,201 tons in 1930. The distribution of Soviet exports during the fiscal years ended September 30, 1927 to 1930, and during the six months, January to June, 1931, is shown in the following table.

Manganese ore exported from U.S.S.R., fiscal years ended September 30, 1927–1930, and January to June, 1931, by countries of destination, in metric tons

Country	1927	1928	1929	1930	January to June, 1931
Belgium	72,064	65,908	98,251	21,052	813
Czechoslovakia	--------	--------	11,068	12,481	34,187
France	80,699	64,532	132,812	84,254	35,349
Germany	72,955	44,062	46,170	90,607	5,104
Great Britain	26,154	13,174	18,519	59,710	1,727
Italy	32,487	46,344	65,537	59,949	8,026
Japan	--------	--------	--------	7,600	--------
Netherlands	244,795	44,953	115,832	54,134	2,032
Poland	21,360	30,820	38,514	27,736	10,164
Sweden	--------	--------	2,089	4,469	--------
United States	214,528	189,088	343,387	257,950	135,037
Other	19,644	1	27,790	194,576	146,041
	784,686	498,882	899,969	874,518	378,480

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[6] Metalbörse, Vom russischen Manganerzexport: Jahrg. 22, No. 22, Mar. 16, 1932, p. 340.

Negotiations [7] between the German interests and the Manganexport have resulted in an agreement under which the former are to take Chiaturi and Nikopol ores, prices being scaled according to quality and quantity. The average price for guaranteed 48 per cent ore is about 8½d. per unit, with extras for washed ore. It is understood that the quantities will fluctuate according to the demand for ferromanganese.

Construction of the Sestaphoni (Chiaturi) ferromanganese plant, which originally was to have been completed about the middle of 1931, will not be completed until sometime early in 1932.

INDIA

India usually ranks second in production of manganese ore; from 1926 to 1930 its output averaged about 1,000,000 long tons. The all-time record of production in India was in 1927, when 1,129,353 long tons were produced; subsequent production has declined and in 1930 amounted to 829,946 long tons. Although production figures for 1931 are not now available exports indicate a substantial decrease in production. The decrease in 1930 was general, being distributed over virtually all producing districts and States. The following table shows the production of manganese ore in India, by Provinces and States, during 1929 and 1930.

Manganese ore produced in India, 1929 and 1930, by Provinces and States, in long tons

Province and State	1929	1930	Province and State	1929	1930
Bihar and Orissa:			Madras:		
Bonai State	----------	165	Bellary	10, 535	3, 470
Keonjhar State	53, 433	37, 356	Cuddapah	----------	50
Singhbhum	22, 698	11, 203	Sandur State	140, 604	145, 961
Bombay:			Vizagapatam	24, 533	13, 213
Belgaum	8, 666	2, 356	Mysore:		
Chhota Udepur	9, 415	3, 984	Chitaldrug	667	241
North Kanara	6, 245	4, 500	Shimoga	38, 436	18, 283
Panch Mahals	56, 326	36, 542	Tumkur	718	278
Central Provinces:					
Balaghat	263, 105	220, 018		994, 279	829, 946
Bhandara	156, 525	150, 133			
Chhindwara	29, 814	27, 170			
Nagpur	172, 559	155, 023			

In 1930, 67 per cent of the total manganese output came from the Central Provinces. The output of these Provinces, like most of the rest of the production in India, must be hauled long distances by rail to Bombay and Calcutta at considerable cost. Although some adjustments in freight rates have been made in the past, the cost of transporting the ore from the mines to the ports is still the vital factor in placing Indian manganese ore on the market; in 1931 further small concessions were made by the transportation companies. Some improvement in the transport problem is expected when the new harbor at Vizagapatam and the connecting railroads are put into service. The Raipur-Vizagapatam branch now under construction will bring the mines 181 miles nearer the coast.

There is a small but steady consumption of manganese ore in the steel works of India; consumption was 46,099 tons in 1930 compared with 47,435 tons in 1929. The bulk of the ore, however, is exported.

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[7] Metal Bulletin (London), No. 1620, Aug. 28, 1931, p. 15.

Exports, including those from Mormugão in Portuguese India, amounted to 773,026 long tons in 1930 compared with 964,489 tons in 1929. The following table, which gives the exports of manganese ore from India from 1927 to 1931, shows that exports from Indian ports (exclusive of those from Mormugão in Portuguese India) in 1931 decreased 59 per cent from 1930 and 63 per cent from the average for the period 1926–1929.

Manganese ore exported from India, 1927–1931, by countries of destination, in long tons

Country	1927	1928	1929	1930	1931
Belgium	174, 485	183, 897	181, 174	98, 205	41, 500
France	151, 100	195, 576	219, 055	208, 887	90, 009
Germany	12, 805	20, 945	12, 630	24, 360	4, 240
Italy	5, 150	9, 475	4, 246	620	----------
Netherlands	12, 500	7, 501	36, 350	11, 500	3, 500
Portuguese India (Mormugão)	162, 378	175, 577	184, 939	170, 577	(1)
United Kingdom	211, 401	159, 227	264, 537	164, 895	61, 313
United States	97, 500	76, 000	51, 250	54, 000	38, 970
Other countries	16, 502	5, 946	10, 308	39, 982	7, 015
	843, 821	834, 144	964, 489	773, 026	[2] 246, 547

[1] Information not available.
[2] Excludes exports via Mormugão.

UNION OF SOUTH AFRICA

Shipments of manganese ore from the Union of South Africa amounted to 103,472 long tons in 1931 compared with 52,296 tons in 1930. All the production came from the Manganese Corporation (Ltd.) in the Postmasburg district. The South African Manganese (Ltd.) also holds large areas in this district but as yet has not found a market for its product. Operations in the Postmasburg district, however, were suspended in September, 1931, due to the low world price of manganese ore and the mounting stocks resulting from curtailed shipments. To effect economies in the cost of putting South African ore on the world market the Manganese Corporation has opened negotiations with the South African Railways for adjustment of rates; it has been granted certain exclusive rights for manganese traffic on this railway and a rate of 15s. 9d. per ton from Postmasburg to Durban. This rate is said to represent nearly 65 per cent of the f. o. b. cost at Durban. In an effort to create further markets for the ore the corporation is investigating the possibilities of establishing a ferromanganese industry at Colenso in the Union of South Africa or in Canada where the Beauharnois Power Corporation is carrying out enormous developments on the St. Lawrence River with the object of obtaining very large supplies of electricity at cheap rates.

The ore from the Postmasburg district is of high grade, and shipments to industrial centers have been favorably received. The ore is classified into grades, the first grade containing 51 per cent manganese, the second 48 per cent, and the third 44 per cent. Workers in the mine can recognize and segregate the various grades.

During the first six months of 1931 exports amounted to 91,894 long tons. The distribution of exports follows.

Manganese ore exported from the Union of South Africa, January to June, 1931, by countries of destination

Country	Long tons	Country	Long tons
Belgium	3, 027	Poland	12, 156
Canada	2, 507	Spain	3, 080
France	60, 403	United Kingdom	1, 502
Germany	2, 004		
Netherlands	7, 215		91, 894

GOLD COAST

During the fiscal year ended March 31, 1931, exports of manganese ore from Gold Coast amounted to 396,044 long tons, compared with 496,486 during the fiscal year 1930. At present there is only one manganese mine in Gold Coast, the Nsuta Mine of the African Manganese Co. (Ltd.) at Nsuta, Western Province. The development of reserves continues to be satisfactory, both in quantity and quality. During the past year a 200-h.p. electrically driven hoist for handling ore on the Dagwin end of the concession was installed, and the railway line to that point was partly completed.

Regarding the origin of the manganese deposits in Gold Coast, Junner[8] has made the following comment:

> The question of the origin of these ores is of considerable economic importance, for if they were formed, as is maintained by certain observers,[9] by the action of descending superficial waters on original sediments containing a relatively small percentage (1 per cent to 20 per cent) of manganese, causing the leaching and removal of the silica and alumina, etc., from the rock and the leaching and redeposition of the manganese in concentrated form, then it is obvious that the extension in depth of workable deposits will be strictly limited.
>
> From his study of the Nsuta ores the writer believes that they represent ancient (pre-Cambrian?) deposits of high-grade manganese ores, which in general have not been modified greatly by vadose waters in recent geological times, and that where the structural features are favorable the ores are likely to persist in depth.

EGYPT

Production of manganese ore in Egypt amounted to 100,174 long tons in 1931 compared with 119,297 tons in 1930. Virtually all the manganese ore produced in Egypt comes from the mines of the Sinai Mining Co. (Ltd.) at Um Bogma on the Sinai Peninsula about 140 kilometers southwest of Suez. Exports of manganese ore from Egypt amounted to only 23,628 long tons in 1931 compared with 71,485 tons in 1930. Production of manganese ore has been severely affected by the difficulties the trade has encountered during the past few years, and the manganese mines have recently suspended operations until disposal of the accumulated production of the past two or three years.

SPAIN

Production of manganese ore in Spain amounted to 17,633 long tons in 1931 compared with 16,553 tons in 1930. In addition, considerable tonnages of ferruginous manganese and manganiferous iron ores are mined and shipped annually.

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[8] Junner, R. N., Report on the Geological Survey Department, 1930–1931—Gold Coast Colony: Accra, 1931, p. 4.

[9] Bishopp, D. W., and Hughes, W. J., A Contribution to the Geology of the Manganese Ore Deposits in the Gold Coast Colony and in Ashanti: Trans. Inst. of Min. and Met., vol. 39, London, 1930, pp. 142–191.

CUBA

Production of manganese ore in Cuba amounted to 94 long tons in 1931 compared with 750 tons in 1930.

The Cuban-American Manganese Corporation, a subsidiary of the Freeport Texas Co., continued to develop its properties at Isabelita near Santiago. Drilling activities have been continued during the year, and substantial additions have been made to the proven reserves adjacent to the mill. The pilot plant and laboratory research work have been carried on continuously, resulting in higher recoveries and an improved product. A new plant capable of producing 100,000 tons of concentrates a year is being constructed and is expected to be in operation by the middle of 1932. It is understood that the manganese oxides will be separated from the gangue by flotation; it is planned to make manganese sulphate as a by-product, using the tailings from the concentrator. The Consolidated Railroads of Cuba has entered into a contract for the construction of a new branch line to connect its main line with the properties of the Cuban-American Manganese Corporation.

CANADA

Canada shipped 173 long tons of manganese ore in 1931 compared with 489 tons in 1930 and 269 tons in 1929. The production in 1931 came from Nova Scotia and New Brunswick. The production from New Brunswick came from Turtle Creek near Moncton, Albert County, and was shipped to furnaces in Cape Breton and Ontario. Work begun in 1930 in connection with the deposits of pyrolusite and manganite at New Ross, Lunenburg County, Nova Scotia, was continued during the summer of 1931. More dump material was treated to recover the manganese content of the smaller sizes.

The proposed erection of a ferromanganese plant at Montreal, in which it is planned to use foreign ore, may stimulate production in New Brunswick and Nova Scotia.

RHODESIA

Production of manganese ore in Northern Rhodesia in 1931 amounted to 1,467 long tons. Manganese mining, which started in 1906, has contributed a total of 6,842 long tons over the 26-year period.

A deposit of manganese ore at Luano near N'Changa, Northern Rhodesia, is being exploited to provide flux for the N'Kana copper smelter.

NETHERLAND EAST INDIES

Exports of manganese ore from the Netherland East Indies for the first half of 1931 amounted to 4,853 metric tons, valued at 359,049 florins, and the output was considerably below the rate of the preceding four years. Germany received 1,821 tons, the United States 1,341 tons, and Japan 380 tons.

Manganese ore is worked principally in the Djokjakarta district, where it is found in an irregular bank 1 to 2 meters thick, between layers of marl and limestone. It is shipped to Europe via the port of Tjilatjap. Manganese ore occurs also in other parts of the Archipelago.

ALGERIA

Algeria exported 498 metric tons of manganese ore in 1931 compared with 1,583 tons in 1930.

YUGOSLAVIA

Manganese ore is found in many places in Yugoslavia,[10] and although there are six manganese mines the only one working at present is the Celjanovići in Bosnia. The ore is found in strata 2 to 5 meters thick imbedded in siliceous clay and is mostly psilomelane with small amounts of pyrolusite. Virtually all the ore, which runs 30 to 49 per cent manganese, is extracted from underground workings. The ore is sent to a mill where it is crushed and washed, and three grades of concentrates are made. The first has 40 to 44 per cent manganese, the second 36 to 39 per cent, and the third 30 to 36 per cent. The manganese product is exported mainly to Greece, Austria, and Czechoslovakia.

NORWAY

During the year the discovery of what is stated [11] to be an extensive deposit of manganese ore was made in Tana, Smalfjord. The deposit is about 2 kilometers long and has an average width of 300 to 400 meters. It is a secondary deposit of bog ore with a manganese content of 13 to 40 per cent.[12] Active steps are being taken to exploit the deposits, and Norwegian manganese ore will be available in the spring of 1932.

Norway exported 32,030 metric tons of ferromanganese in 1931 compared with 47,848 tons in 1930.

CHINA

Figures on production of manganese ore in China are not available; exports, which go mainly to Japan, amounted to 21,702 long tons in 1931, a large decrease from the 53,988 tons exported in 1930.

The manganese ore mined in the Yansing district of Hupeh is largely absorbed by the Hangchping Co. at its iron and steel works in Hanyang. The deposits consist of replacement ore of manganiferous hematite or limonite in limestone. Serious production in China began with the discovery of sedimentary beds in Hunan and Kwantung.

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[10] Lakatos, Joso, Mining in Yugoslavia: Belgrade, 1931, p. 47.

[11] Iron and Coal Trades Review, Norwegian Manganese Ore: Vol. 123, No. 3328, Dec. 11, 1931, p. 916.

[12] Mining Journal (London), Norway in 1931: Vol. 176, No. 5034, Feb. 13, 1932, p 23.

MANGANESE ORE IMPORTED INTO MAIN CONSUMING NATIONS

Manganese ore imported into the principal consuming countries, 1927–1931, by countries from which imported, in long tons

Importing country	Country from which imported	1927	1928	1929	1930	1931	Source of information
Belgium-Luxemburg Economic Union.	Brazil	--------	37,752	18,263	1,551	--------	Official trade returns.
	British India	94,857	122,977	149,868	117,198	98,848	
	Egypt	980	--------	--------	(1)	--------	
	France	--------	--------	--------	16,108	12,797	
	Gold Coast	--------	--------	--------	7,727	1,358	
	Portuguese India	--------	12,611	19,270	17,895	9,866	
	Russia	75,183	68,254	87,610	64,524	96,833	
	Other countries	94,090	21,333	48,466	30,540	18,596	
		265,110	262,927	323,477	255,543	238,298	
France	Brazil	22,174	42,489	70,532	16,428	3,832	Commerce Extérieur de la France.
	British India	257,077	262,877	272,512	288,512	132,891	
	British West Africa	31,984	77,203	101,107	82,551	30,579	
	Russia	77,508	108,667	181,132	189,021	134,816	
	Spain	40,546	13,031	18,969	21,370	1,565	
	Other countries of Asia	34,979	41,793	36,294	12,701	30,476	
	Other countries	184,904	180,511	107,050	93,175	139,494	
		649,172	726,571	787,596	703,758	473,653	
Germany	Brazil	2,529	27,372	3,617	523	--------	Official German trade statistics.
	British India	75,431	124,594	128,485	77,116	23,016	
	British West Africa	(1)	(1)	(1)	328	234	
	Dutch East Indies	6,133	12,567	7,765	3,749	3,457	
	Egypt	46,092	29,489	35,044	17,208	11,015	
	Russia in Europe	(1)	(1)	(1)	170,921	109,697	
	Russia in Asia	207,312	71,060	175,933			
	Other countries	29,567	14,669	30,421	60,233	12,378	
		367,064	279,751	381,265	330,078	159,797	
Great Britain	British countries:						Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions.
	British India	176,757	175,378	259,260	184,326	(2)	
	Gold Coast	505	1,319	1,380	2,297	(2)	
	Other British countries	130	1,500	190	5,209	(2)	
		177,392	178,197	260,830	191,832	(2)	
	Foreign countries:						
	Brazil	1	8,010	--------	--------	(2)	
	Java	1,973	1,998	1,361	1,225	(2)	
	Netherlands	197	583	629	413	(2)	
	Portuguese possessions in India.	--------	13,005	11,256	10,323	(2)	
	Russia	13,061	1,750	10,046	8,401	(2)	
	Spain	3,291	--------	2,289	1,270	(2)	
	Other foreign countries	2,612	2,422	2,942	2,980	(2)	
		21,135	27,768	28,523	24,612	(2)	
		198,527	205,965	289,353	216,444	78,265	
Netherlands	Dutch East Indies	1,212	1,895	1,231	1,336	--------	Maandstatistiek van den in-uit-en doorvoer.
	Egypt	--------	3,200	6,339	--------	--------	
	France	453	257	639	464	395	
	Germany	225	316	289	548	594	
	Russia in Europe	3,961	300	4,618	--------	28,231	
	Other countries	803	54	325	368	644	
		6,654	6,022	13,441	2,716	29,864	
United States	Africa (British):						Foreign Commerce and Navigation of the United States.
	South	--------	5	--------	--------	5,002	
	West	87,230	24,186	33,593	93,142	87,439	
	Brazil	174,026	142,300	216,535	185,048	133,927	
	British India	93,017	83,600	72,940	58,150	47,850	
	Canada	430	3,929	4,804	15,998	18,832	
	Chile	3,206	9,340	2,000	3,485	1,748	
	Cuba	8,976	3,180	2,667	2,071	3,804	
	Egypt	--------	--------	101	--------	--------	
	Germany	65	133	1,137	66	30	
	Italy	--------	--------	71	--------	--------	
	Java and Madura	1,527	1,026	1,000	1,602	1,754	
	Russia in Europe	253,544	159,842	329,336	225,888	195,834	
	United Kingdom	46	167	85	109	6,298	
	Other countries	--------	--------	--------	9	--------	
		622,067	427,708	664,269	585,568	502,518	

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[1] Included under "Other countries."

[2] Information not available.

VANADIUM, URANIUM, AND RADIUM[1]

By F. L. Hess[2]

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THE DOMESTIC SITUATION

The demand for radium, uranium, and vanadium, like that for most other substances, was small during 1931.

Of American companies mining one or more of the three elements, only the United States Vanadium Corporation, with a roscoelite mine on East Rifle Creek 11 miles north and a little east of Rifle, Colo., and a reduction plant on the railroad at Rifle, did any large amount of business. The ore carried 2.08 per cent V_2O_5.

The International Vanadium Corporation, with a mine and reduction plant in Dry Valley about 55 miles southeast of Moab, Utah, and 80 miles by road from the railroad at Thompsons, was inactive during most of the year. W. C. Paterson,[3] who developed the process used at the plant, published an incomplete description of the process.

The mill of the Rare Metals Corporation near Naturita, Colo., was idle during the year and was sold at public auction under foreclosure proceedings on December 21, 1931.[4] The mill was built in 1930 at a cost said to be more than $350,000 to make vanadium oxide from carnotite-bearing ores. It was intended to save radium and uranium as by-products after the mill became established, but it operated only a short time. The mill and the claims on which the deposits are located were bought on a bid of $428,000 by the Vanadium Corporation of America, which had loaned $300,000 to the Rare Metals Corporation.

The United Vanadium Corporation (not to be confused with the United States Vanadium Corporation at Rifle) produced some vanadinite concentrates at Dripping Springs, Ariz., but made no shipments. The company is also interested in vanadinite-bearing properties near Wickenburg.

In Gilpin County, Colo., an effort was made to produce pitchblende from the old Kirk Mine near Central City, but no output was reported.

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[1] Work on manuscript completed July, 1932.

[2] Statistics on domestic production prepared by H. W. Davis, of the Bureau of Mines. Figures on imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

[3] Mining Review (Salt Lake City), Vanadium from Utah Carnotite Fields: Vol. 33, 1931, pp. 7–10.

[4] Mining Journal (Phoenix, Ariz.), vol. 15, 1932, p. 32.

The Torbena Products Co., Allentown, Pa., used torbernite from the White Signal district, about 10 miles south of Tyrone, N. Mex., for making radioactive drinking water.

No definite tests of the value of radioactive drinking water to show whether it is of benefit or harm, or whether, if beneficial, under what conditions and dosage, are known to have been recorded. It is well known that overdoses of radium are very harmful. It has been widely believed that radioactive water properly used may be distinctly beneficial, but the fact has not yet been shown by controlled experiments.

In Utah some rich carnotite ore was sold by H. W. Balsley of Moab for therapeutic purposes and for fertilizer in citrus orchards of California and Florida. The value of radioactive fertilizer materials, like that of radioactive drinking water, probably needs further careful investigation.

As figures for production would disclose individual returns, they may not be given.

PRICES

During 1931 prices were largely a matter of bargaining—entirely so as far as uranium ores were concerned. Vanadium ore was quoted through the year at 26 to 28 cents per pound for the V_2O_5 contained, f. o. b. shipping point, but this quotation was nominal.

Ferrovanadium was quoted at $3.15 to $3.50 per pound of contained vanadium, delivered, the price depending upon the quality. Fused vanadium oxide containing 86 to 92 per cent V_2O_5 was nominally priced at 70 cents to $1.50 per pound of contained V_2O_5.

IMPORTS

Imports of vanadium and of uranium and radium in various forms for several years are shown in the following tables.

Vanadium ore (steel-hardening) imported for consumption in the United States, 1927–1931[1]

Year	Pounds	Value	Year	Pounds	Value
1927	13,885,760	$561,051	1929	19,519,360	$794,734
1928	1,104,320	49,771	1930	11,576,320	491,633

[1] No imports reported for 1931.

Uranium and radium salts imported for consumption in the United States, 1928–1931

Class	1928		1929		1930		1931	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Uranium oxide and salts of pounds	165,378	$145,557	272,913	$344,548	231,194	$306,566	180,049	$233,601
Radium salts grams [1]	10.97	566,977	10.69	579,085	16.86	924,852	13.41	731,204
Radioactive substitutes	(2)	2,913	(2)	183	(2)	971	(2)	267
		715,447		923,816		1,232,389		965,072

[1] Bureau of Foreign and Domestic Commerce publishes quantities as follows: 1928, 169 grains; 1929, 165 grains; 1930, 260 grains; 1931, 207 grains.

[2] Weight not recorded.

Items besides those given in the preceding table were: Radium cream imported from Austria, valued at $5,985, and radium compresses imported from Czechoslovakia, valued at $2,120.

FOREIGN COUNTRIES

URANIUM AND RADIUM

The Katanga uranium-radium deposits continued to give the world the larger part of its radium supply; but the outstanding event of the year was the discovery of silver-bearing pitchblende deposits on and near LaBine Point on the east side of Great Bear Lake, Mackenzie district, Northwest Territories, Canada.

Sales of radium by the Union Minière du Haut Katanga during 1931 are said to have been about 60 grams,[5] as in the two preceding years.

According to published report 382 metric tons of uranium ore were shipped from Katanga to Belgium in 1931 compared with 1,295 tons in 1930.[6] However, M. Crokaert, Belgian Colonial Minister, reported an output of 5,956 tons of uranium ore in 1930.[7]

The discovery of pitchblende by Gilbert LaBine on Great Bear Lake was announced in 1930, and the find was prospected during 1931. LaBine Point, as the part of the shore where ore was discovered was named, is on the east side of the lake about 35 miles south of the Arctic Circle and is in nearly the same latitude as Fairbanks, Alaska. The country has been heavily glaciated and is bleak and inhospitable. It has heretofore been reached in the summer by the Mackenzie River from Waterways by canoe or on a Hudson Bay Co. steamer to Bear River, thence by canoe up the river and across the lake—a trip requiring six weeks by canoe and three weeks or more by steamer—or in the winter by dog team, requiring about as long as the canoe trip. Now a train runs from Edmonton to Waterways (350 miles), and the trip requires about a day. Thence, an airplane trip of 850 miles lands one at LaBine Point or other places in the vicinity in another day.

The climate is severe. Airplanes fitted with skis can make the trip during about three months of the winter. Darkness at Great Bear Lake makes landing bad during part of the winter. Ordinarily, the ice breaks up on the bays about the last of June, but the lake is not free until the second half of July. Freezing begins after August 15.

The Canadian Government dispatched topographers,[8] a geologist,[9] and a representative from the Mines Branch[10] to the area; all have issued valuable reports. The Mines Branch investigated the isolation of radium from the ores and made flotation tests for removing the sulphides but did not find the process very satisfactory. Analyses of two samples gave:

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[5] Rhodesian Mining and Engineering Year Book, 1932, Johannesburg, 1932, p. 100.

[6] Mining Journal (London), vol. 177, 1932, p. 296.

[7] Rhodesian Mining Journal (Johannesburg), vol. 6, 1932, p. 100.

[8] McDonald, R. C., Surveys at Great Bear Lake, 1931: Canadian Min. and Met. Bull. 240, 1932, pp. 209–223.

[9] Kidd, D. F., A Pitchblende Silver Deposit, Great Bear Lake, Canada: Econ. Geol., vol. 27, 1932, pp. 145–159.

[10] Spence, H. S., Great Bear Lake Finds Look Good to Government Expert: Northern Miner, vol. 17, 1931, pp. 1 and 3; Radium and Silver at Great Bear Lake: Min. and Met., vol. 13, 1932, pp. 147–151; Radium-Bearing Minerals from Great Bear Lake. Northwest Territories: Canadian Mines Branch Mem., ser. 48, 1931, 4 pp.; Occurrences of Pitchblende and Silver Ores at Great Bear Lake, Northwest Territories: Canadian Mines Branch Mem., ser. 51, 1931, 6 pp.

Part analyses of pitchblende ore from LaBine Point, Great Bear Lake, Mackenzie district, Canada

	A	B		A	B
U_3O_8 ....per cent..	56.91	63.94	Bi ....per cent..	0.18	Trace.
Th ....do....	Nil.	Nil.	As ....do....	.15	.14
V_2O_5	Trace.	Nil.	Fe ....do....	1.01	.77
Cu ....per cent..	.70	.66	S ....do....	2.08	.90
Ni	Trace.	Trace.	Ag ....ounces per ton..	1.41	1.72
Co ....per cent..	.13	.10	Au ....do....	.19	Trace.
PbO ....do....	12.00	12.13			

Reid[11] also published an article on the occurrence of ores in the region.

The Royal Canadian Air Force took a fine series of photographs which, due to their own excellence and to the glaciated bareness of the country, show faulting, jointing, and topographical features with such remarkable clearness that they are very helpful in prospecting.

The country has a relief of about 1,000 feet above Great Bear Lake with precipices of 500 feet. The rocks are highly metamorphosed and may have been sediments or tuffs. They are at the edge of the Canadian shield (an area of very old granitic rocks) and have been intruded by granites.

Spence[12] has given a detailed description of the deposits at La Bine Point.

It has been reported that the Northern Aerial Mineral Explorers (N. A. M. E., as it is usually known) has found uranium minerals and silver 6 miles north of LaBine Point.

The Eldorado Mining Co. was taking active steps before the end of the year looking toward the establishment of a radium isolation plant.

Two companies, the Ontario Radium Corporation (Ltd.) and the Canada Radium Mines (Ltd.), started work with the intention of mining and isolating radium from uraninite found in pegmatites near Wilberforce, Ontario. The former sent a 32-ton sample to the Ore Dressing and Metallurgical Laboratory of the Department of Mines at Ottawa for testing.[13]

In Australia[14] the Australian Radium Corporation N. L. has kept up its interest in the radioactive deposits at Mount Painter in the desert northeast of Adelaide. Compared with the uranium deposits of Katanga and Great Bear Lake the Mount Painter deposits are very lean. The Radium & Rare Earths Treatment Co. N. L., which had a property at Olary, also northeast of Adelaide, had expected to make titanium white from rutile in the vein but found it impracticable.[15]

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[11] Reid, J. A., The Minerals of Great Bear Lake. Note on the Geology and Mineralization of the Echo Bay Region, Great Bear Lake: Canadian Min. Jour., vol. 53, 1932, pp. 61–66.

[12] Spence, H. S., Great Bear Lake Finds Look Good to Government Expert: Northern Miner, vol. 17, 1931; pp. 1 and 3.

[13] Chemical News (London), vol. 142, 1931, p. 377.

[14] Industrial Australian and Mining Standard, vol. 87, 1932, p. 176.

[15] Industrial Australian and Mining Standard, vol. 85, 1931, p. 288.

No definite figures on the production of radium and uranium salts at Jachymov (Joachimsthal), Czechoslovakia, are yet available, but the annual production is about 3.5 grams of contained radium.

A rare metals plant at Moscow, Russia, was at work on the isolation of radium from the tyuyamunite (hydrous calcium uranium vanadate, lime carnotite) from Ferghana, but the plant apparently did not reach production until early in 1932.[16]

REPORTS OF THE NATIONAL RADIUM TRUST AND RADIUM COMMISSION OF GREAT BRITAIN

So little information is readily available on the medical handling of radium that the reports of well-organized bodies dealing with considerable quantities of radium are of general public interest.

Several years ago when the King of England recovered from a very serious illness the London Times received thank offerings from the people to buy radium for British hospitals. A National Radium Trust to buy and hold title to the radium and attend to collateral business and a Radium Commission of prominent medical men to plan for its actual use were appointed under royal charter. These data are taken from their annual reports for 1929–30 and 1930–31:

The Times turned over to the trust £150,000, Parliament furnished £100,000, and smaller sums were donated by others. Teaching hospitals were selected at 12 places outside of London (7 in England, 4 in Scotland, and 1 in Wales) as centers for treatment by radium, and another center was started in London. The radium is loaned for 2 per cent of the cost, and an agreement is made that not more than 20 per cent of paying patients shall be treated with it. It was found that an insufficient number of practitioners trained in radium therapy were available, and a National Post-Graduate School of Radio-Therapy was founded.

At the date of the second report, October, 1931, 24.9 grams of radium (element) had been ordered from the Union Minière du Haut Katanga at $50,000 per gram, of which 21.8 grams had been received and 17 grams had been delivered to centers. A small lot of 118 milligrams was obtained from Cornish ores.

Most of the radium is in small platinum tubes and needles. The cost of measuring and filling the tubes with radium is, to one not used to such operations, surprisingly high, running from about 12 to more than 16 per cent of the cost of the radium itself. Three grams were used for the collection of radon; 1 gram was loaned for research work in therapy; and 0.18 gram was loaned to the National Physical Laboratory for other research.

Besides the radium furnished by the National Radium Trust most of the centers had radium of their own (of which 3.461 grams are listed), which is carefully kept separate. There is also a considerable quantity of radium in other hospitals and radium institutes.

VANADIUM

The Vanadium Corporation of America shipped no vanadium from Peru in 1931. By a decree issued October 28, 1930, the export tax on vanadium was fixed at 45.29 soles (about $12.68 at par) per metric ton, regardless of the grade and market price.[17]

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[16] Economic Review of the Soviet Union, vol. 7, 1932, p. 115.

Some mottramite was found in red sandstone 100 kilometers northeast of Eucaliptus, Bolivia, during the year, but according to a communication from D. W. Metzelar, received by the author, the deposit apparently has no commercial importance.

At Broken Hill, Northern Rhodesia, the Rhodesia Broken Hill Development Co. (Ltd.) completed, late in 1930, a plant with a capacity of 50 tons per month for the production of fused vanadium oxide. The ore mineral used is mostly descloizite, but there is also some vanadinite; they are found in the oxidized parts of the great lead-zinc deposits. Large stock piles of high-grade vanadium ore had been accumulated before the vanadium plant started operation.[18] Operation began in January, 1931,[19] with an output of 10 long tons of fused oxide for the month. In July the output had increased to 25 long tons (28 short tons) per month [20] and by January, 1932, to 51 short tons of fused vanadium oxide carrying 90 per cent V_2O_5.[21] A monthly output of 100 tons of concentrates carrying 16 per cent V_2O_5 was reached in the second half of the year.

The fused vanadium oxide and vanadium concentrates are sold in Germany and France and have furnished sufficient profit to carry the expense (£6,000 per month) of caring for the entire lead and zinc plant and to leave a small surplus.[22]

The output for the year was 337,855 pounds of vanadium in fused vanadium oxide carrying 90 per cent V_2O_5 (about 335 short tons of fused oxide), valued at £227,000, and 671 short tons of concentrates carrying about 9 per cent V. The total vanadium content in fused oxide and concentrates was about 229 short tons.

The process for the separation of the vanadium oxide from the concentrates has been described in the technical press.[23]

The discovery of vanadinite on six farms in western Transvaal was reported during the year, but details are lacking.[24]

In South-West Africa development at the Abenab Mine was carried on 30 to 40 feet below water level, and ore reserves were increased about 3,000 tons.[25]

At the Tsumeb Copper Mine, Otavi, South-West Africa, for the year ended March 31, 1931, "the operations of the ferrovanadium works were less than those of the preceding year but were on the whole satisfactory." [26]

The exports of vanadium for the year amounted to 4,413 short tons, valued at £130,595. All went to Germany. In 1930 the exports were 4,295 tons, valued at £150,818.[27]

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[17] Cunningham, C. H., Commerce Repts., vol. 1, 1931, p. 57. Tax given as equal to $18.12.

[18] Engineering and Mining World, vol. 2, 1931, p. 121.

[19] Mining Magazine (London), vol. 45, 1931, p. 128.

[20] Engineering and Mining Journal, vol. 132, 1931, p. 136.

[21] Rhodesian Mining Journal (Johannesburg), vol. 6, 1932, p. 159.

[22] Mining Journal (London), vol. 174, 1931, p. 606.

[23] Mining Magazine (London), The Recovery of Vanadium Pentoxide at the Rhodesia Broken Hill: Vol. 44, 1931, pp. 88–89.

[24] Mining Magazine (London), vol. 45, 1931, p. 161.

[25] Davis, Sir Edmund, quoted in South African Mining and Engineering Journal, vol. 41, pt. 2, 1931, p. 483.

[26] Mining Magazine (London), Otavi Mines: Vol. 45, 1931, p. 128.

[27] Annual Statement of the Trade and Shipping of the Union of South Africa and the Territory of South-West Africa, Calendar Year, 1931, p. 547.

MERCURY [1]

By P. M. Tyler and H. M. Meyer [2]

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STATISTICAL SUMMARY

Summary of statistics for mercury in the United States, 1930 and 1931

[Flasks of 76 pounds]

	1930	1931
Production ... flasks	21, 553	24, 947
Number of producing mines	75	77
Average price per flask:		
New York	$115. 01	$87. 35
London	£21 15s. 8d.	£19 15s. 10d.
Imports for consumption ... pounds	283, 086	41, 733
Imports for consumption ... equivalent in flasks	3, 725	549
Apparent supply ... flasks	25, 200	20, 512
From domestic mines ... per cent	85	97
Stocks in warehouse (bonded) at end of year ... flasks	305	88

INTRODUCTION

The consumption of mercury in the United States, and probably in Europe also, declined approximately one-third in 1931, compared with the preceding year. Production, on the other hand, increased rapidly in the United States and Mexico, and instead of buying large quantities of mercury from Europe the North American Continent began exporting considerable amounts. Production also increased in certain other localities. Under the combined pressure of increased supplies from uncontrolled sources and of increasing hesitancy of buyers to commit themselves on a declining market, the powerful cartel—comprising the leading European producers—was placed in a decidedly uncomfortable position. Prices were cut sharply on June 1 and in September there was a further slight readjustment, but the cartel was wholly unable to liquidate the large stocks that had been accumulated during the preceding two years. To the disinterested observer, however, the significant facts are that consumption of mercury was moderately well maintained, compared with much reduced demand for other metals, and that increases in production outside of the leading countries were not large enough to foreshadow any drastic shift in the supply situation. Minor changes, although locally important, have not developed into an effective challenge to the natural leadership of Spain and Italy as purveyors of mercury to the markets of the world.

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[1] Work on manuscript completed July, 1932.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

DOMESTIC PRODUCTION

The production of mercury in the United States in 1931 increased to 24,947 flasks, with a nominal value of $2,179,145, compared with 21,553 flasks, valued at $2,478,789, in 1930. Although the quantity increased 16 per cent, the total value declined 12 per cent. Even more serious than the decline in price was the difficulty most operators experienced in disposing of their product promptly; and as so many mines were forced to suspend operations until they could realize on their stocks of metal on hand, the showing made by producers was all the more remarkable. The 1931 output is the largest since the World War and has been exceeded only three times since 1906. The number of producing mines increased to 77 in 1931, compared with 75 in 1930 and only 13 in 1925. California had the largest number of new properties to reach the producing stage; in that State 45 mines reported production in 1931, compared with 40 in 1930. In Washington 3 additional mines came into production, but in Nevada the number of producing mines decreased from 20 to 16. In Oregon, consolidation of producing interests reduced the number of enterprises in the face of a substantial increase in output.

Mercury produced in the United States, 1928–1931

	Producing mines	Flasks of 76 pounds	Value
1928:			
California	26	6,977	$861,692
Nevada	17	2,867	354,061
Oregon	4	3,710	458,147
Texas, Washington, and Arizona	7	4,316	533,103
	54	17,870	2,207,003
1929:			
California	29	10,139	1,238,428
Nevada	19	4,764	581,899
Oregon	5	3,657	446,684
Washington	2	1,397	170,637
Texas, Arizona, and Alaska	8	3,725	454,990
	63	23,682	2,892,638
1930:			
California	40	11,451	$1,316,968
Nevada	20	3,282	377,460
Oregon	7	2,919	335,711
Washington	1	1,079	124,095
Texas, Arizona, and Alaska	7	2,822	324,555
	75	21,553	2,478,789
1931:			
California	45	13,448	1,174,696
Nevada	16	2,217	193,657
Oregon	5	5,011	437,716
Washington	4	560	48,917
Texas, Arizona, Arkansas, and Alaska	7	3,711	324,159
	77	24,947	2,179,145

California easily retained first place among the mercury-producing States; it furnished 13,448 flasks (54 per cent of the total), an increase of 17 per cent compared with 1930 and slightly more than the increase for the country as a whole. Oregon, however, registered the largest proportionate increase in production, advancing to second place among the States with an output of 5,011 flasks (72 per cent more than in 1930). Production in Nevada dropped from 3,282 flasks in 1930 to 2,217 flasks in 1931 (32 per cent). The output of Texas, on the other hand, increased. Arkansas started producing in 1931, a small output being reported from ore produced in exploring the newly discovered deposits, and the State may soon rank as an important source of the metal if the hopes of several operators are realized.

IMPORTS

The imports of mercury for consumption in 1931 were less than in any year since 1910; they amounted to only 549 flasks, a reduction of 85 per cent compared with 1930 and of 98 per cent compared with 1926. Virtually all the imports represented deliveries under old contracts, and almost one-half constituted withdrawals from bonded warehouses of metal shipped in previous years. Less than 6 flasks were received from Mexico and only 350 flasks from Spain. Other countries which formerly have exported mercury to the United States made no shipments to this country in 1931.

The imports of mercury compounds were halved in 1930 and were almost halved again in 1931.

Mercury imported into the United States, 1928–1931, by countries

[General imports]

Country	1928		1929		1930		1931	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Belgium	68,454	$93,823	94,969	$129,083				
Canada	5	10	37,500	52,195	5	$9		
France			24,587	33,966				
Germany	40,954	57,414	53,259	70,677				
Hong Kong			3	4				
Italy	428,821	558,622	67,778	90,532				
Mexico	136,208	176,968	91,854	122,229	10,716	13,747	445	$622
Peru			960	700				
Spain	464,206	643,621	715,311	947,756	212,965	282,073	26,609	32,027
United Kingdom	30,100	41,559						
	1,168,748	1,572,017	1,086,221	1,447,142	223,686	295,829	27,054	32,649

Mercury compounds imported for consumption in the United States, 1930 and 1931

Compound	1930		1931	
	Pounds	Value	Pounds	Value
Chloride (mercuric) (corrosive sublimate)	46	$43	100	$75
Chloride (mercurous) (calomel)	1,875	3,262	2,021	3,138
Oxide (red precipitate)	10	21		
Mercury preparations (not specially provided for)	1,248	2,451	1,472	2,209
Vermilion reds (containing quicksilver)	42,821	55,033	25,365	30,463
	46,000	60,810	28,958	35,885

EXPORTS

In 1931 the United States exported 4,984 flasks of mercury, valued at $433,596 (according to figures compiled at the request of the Bureau of Mines by the customs statistics section of the Bureau of Foreign and Domestic Commerce), compared with exports of only 114 flasks in 1926, the latest previous year for which figures are available. In

1931, moreover, exports constituted virtually a net surplus of domestic production in excess of domestic consumption, as imports were only 549 flasks, most of which represented deliveries under unexpired long-term contracts. Although it was known even in 1930 that exports had been resumed after being virtually nonexistent for many years, trade estimates generally placed the 1931 total far below the actual figure of nearly 5,000 flasks.

Approximately one-half of the total exports was shipped to Europe, and Germany was the largest purchaser. Asia accounted for nearly one-third, shipments to Hong Kong being exceeded only by those to Germany. North American countries took only 856 flasks, most of which went to Canada. Mexico was formerly a fairly important market for mercury, but during the last year or two has become an exporter of the metal.

Over 50 per cent of the exports were shipped during the first four months of the year. The Mercurio Europeo, the foreign sales cartel, cut its price to the American level June 1, and for two months domestic exports dropped to small proportions. Exports increased sharply in August and September but declined to moderate proportions toward the end of the year.

Shipments to the Far East were made principally from San Francisco, the primary market for most of the metal produced in the Pacific Southwest. Exports to Europe were evenly divided between Pacific ports and New York, the leading market for domestic consumption. Canadian shipments were routed via border ports, mostly along the St. Lawrence, but the business was probably transacted mainly through New York.

MARKETS AND PRICES

The average annual price of mercury in the United States from 1850 to date has fluctuated between a minimum of $28 (in the eighties) to a maximum of over $127 (in 1916). For several years before 1930 the New York price was virtually the European price plus the cost of importation. Practically throughout 1931, however, quotations for import metal were far above the prices at which the product of domestic mines was being sold. Much of the time the New York price was approximately the same as the European price despite the duty of $19 a flask; in fact, sometimes the latter was higher, so that occasionally domestic firms could sell their mercury to better advantage in Europe than in the United States. In 1928 the Mercurio Europeo established its price at £21 15s. (f. o. b. Spanish or Italian port or franco the respective frontiers) and held to within £1 of this figure until June 1, 1931, when it was reduced to £16 15s. This new price, equivalent to $81.50 with sterling at par, was shaded to $80 in London when Great Britain suspended the gold standard, and the local representatives of the cartel in New York began quoting $78.30 to $80 for delivery in the United States in bond. By cutting its price on June 1 the cartel virtually restored the parity of foreign and domestic metal on the New York market. Imports were not stimulated; but the effect was temporarily to check exports, which were not resumed until competition between American producers reduced the domestic price to lower levels.

The downward movement in the domestic price continued fairly steadily, except for a brief reaction in April. The average monthly quotations dropped from $103 in January to $66 in December. Marked slowing up in the decline was observed by November, as the price fell below $70, apparently the marginal point below which production at many domestic mines ceases to be profitable. The decrease in American production, therefore, accounts for the relatively small exports, despite the fact that at the end of the year the European price was nominally $15 a flask higher than the American market instead of $19 or $20 lower, as one might expect under normal conditions of domestic consumption and supply.

The reductions by the cartel in 1931 failed to stimulate buying, but shortly after the close of the year the official price was cut to $65, which was approximately the New York level. A little later (February, 1932) the cartel transferred some of its sales activities to the London firm of Roura & Forgas (14 Seething Lane, London, E. C. 3), thereby making London once more the major market instead of Lausanne, the headquarters of the cartel. Details of the new arrangement have not been disclosed in the trade press. It appears, however, that the London firm, which formerly represented the cartel in the British Empire, in consideration of being appointed "sole importing buyers" for the world, guaranteed to take 30,000 flasks a year for three years at a specified price. The cartel has been represented in France by Rene Weil and in Germany by Aaron Hirsch.

The Italo-Spanish combine or cartel comprises the following productive units: Minas de Almadén of Madrid; Monte Amiata S. A. N. of Rome; R. Miniera di Idria of Trieste; Stabilimento Minerario del Siele of Leghorn; and Società Mercurifera Italiana of Rome. The output of the smaller Spanish mines is apparently sold on the free London market independently of the cartel.

Average yearly prices of mercury in the United States and the United Kingdom, 1918–1931

[Per flask of 76 pounds, except as indicated]

Year	San Francisco (domestic)[1]	New York [2]	London [3]			Year	San Francisco (domestic)[1]	New York [2]	London [3]		
			£	s.	d.				£	s.	d.
1918 [4]	$117.50	$123.47		(5)		1925 [4]	$82.67	$83.13	13	17	1
1919 [4]	90.29	92.15	20	9	5½	1926 [4]	91.60	91.90	15	13	6
1920 [4]	79.66	81.12	20	14	9	1927	117.61	118.16	21	7	11
1921 [4]	47.42	45.46	11	3	5	1928	[6] 125.34	123.51	22	6	1
1922 [4]	57.78	58.95	11	11	6	1929	[6] 124.00	122.15	22	5	2
1923 [4]	65.68	66.50	10	4	9	1930	(7)	115.01	21	15	8
1924 [4]	68.69	69.76	11	19	8	1931	(7)	87.35	19	15	10

[1] Mining and Scientific Press, San Francisco.

[2] Engineering and Mining Journal, New York. {Eng. and Min. Jour.-Press, 1922–1925; Eng. and Min. Jour., 1926–1931.

[3] Mining Journal (London).

[4] Price quoted on 75-pound flask prior to 1927.

[5] Quoted as "nominal" only.

[6] Beginning Oct. 27, 1928, quotations for San Francisco are on basis of "retail and small wholesale lots."

[7] Not given.

CONSUMPTION AND SUPPLY

Supply of mercury in the United States, 1922–1931

[Flasks of 76 pounds]

Year	Production	Imports for consumption	Exports	Apparent supply		
				Total	From domestic mines	Imported
	Flasks	*Flasks*	*Flasks*	*Flasks*	*Per cent*	*Per cent*
1922	6,291	16,697	287	22,701	26.4	73.6
1923	7,833	17,836	314	25,355	29.7	70.3
1924	9,952	12,996	205	22,743	42.9	57.1
1925	9,053	20,580	201	29,432	30.1	69.9
1926	7,541	25,634	114	33,061	22.5	77.5
1927	11,128	19,941	(1)	[2] 30,900	35.5	64.5
1928	17,870	14,562	(1)	[2] 32,300	54.9	45.1
1929	23,682	14,917	(1)	[2] 38,500	61.3	38.7
1930	21,553	3,725	(1)	[2] 25,200	85.2	14.8
1931	24,947	549	[3] 4,984	20,512	97.3	2.7

[1] Not separately classified, 1927–1930. [2] Estimated by Bureau of Mines.

[3] From a special compilation made by the customs statistics section, Bureau of Foreign and Domestic Commerce.

The Mercurio Europeo has made some effort to increase the consumption of mercury, and in 1929 it offered £5,000 for any discovery which would lead to a consumption of 5,000 flasks for a new use by 1935. With the exception of the mercury boiler, which had already been in use when the offer was made, no single outlet of this magnitude has ever been developed. Continued expansion of the electrical industry will undoubtedly call for increased quantities of mercury; and some of the relatively new items such as sun lamps, special switches, Cooper-Hewitt lamps, and mercury-arc rectifiers may individually require substantial amounts of the metal, but the fact remains that the mercury trade is characterized by the absence of outstandingly large outlets and the diversity of minor outlets.

In 1931 a number of patents were issued covering the use of small percentages of mercury in alloys, including bearing-metal alloys, and a Japanese patent mentions its use in plating iron with lead. Mercury also appears in certain metallic catalysts used in the ever-growing number of synthetic chemical operations. The use of organic mercury compounds for preventing seed grain from mildewing and glue and sundry other manufactured products from spoiling is still receiving attention. Of possible interest is a centrifugal device for separating liquids from solids in which a layer or stream of mercury serves as a carrier of the solids. (British patent 339566, March 4, 1929). Tentative specifications for mercury for dental amalgams were set up by the American Dental Association on the basis of recommendations proposed by the United States Bureau of Standards.[3] One requirement is that metal especially purified for such use should be packed in clean, clear glass containers. A German article[4] describes the use of mercuric carbonate in amounts of 0.1 and 2.5 per cent as additions to glass melts. Only a small fraction of the quantity added to the batch remains in the glass; but the effect is to color the glass golden yellow to bluish green, depending upon conditions. Improvements in various electrical apparatus were likewise reported in 1931, but despite these numerous developments the year passed without any outstanding new uses being reported.

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[3] Isaacs, A., Mercury for Dental Amalgams: Jour. Am. Dental Assoc., vol. 19, January, 1932, pp. 54–57.

[4] Zschacke, F. H., Mercury Glasses: Glastech. Ber., vol. 8, No. 9, 1930, pp. 519–525; Ceram. Abs., vol. 10, No. 7, 1931, p. 488.

The largest installation of mercury-arc rectifiers in the United States has been undertaken to supply direct current for the new Eighth Avenue Subway in New York City. This project includes more than 200 track miles and requires 51 rectifiers.

Two mercury-vapor boiler installations may be completed in 1932. That at Schenectady, the largest to date, developing 26,700 horsepower, is estimated to cost $4,000,000. Conditions in 1931 did not encourage the power companies to commit themselves to additional expenditures of such magnitude; but as the success of this type of power unit has now been demonstrated, undoubtedly additional plants will be built as soon as normal conditions are restored. The initial cost is very large but does not compare unfavorably with that of many hydroelectric developments of similar magnitude, and in many industrial districts such highly efficient fuel-burning plants appear to be the most economical to build.

METALLURGY

Recent trends in plant design and various economic aspects of the metallurgy of mercury have been reviewed in two articles by Schuette.[5] The use of multiple-hearth furnaces of the Nichols-Herreshoff type also was described.[6] In Russia the Dwight-Lloyd machine has been employed, probably for the first time in mercury metallurgy.

MINING INDUSTRY BY STATES

ALASKA

The following notes on mercury operations in Alaska in 1930 are taken from a report of the United States Geological Survey.[7]

According to reports, a little mercury ore was mined and a small quantity of metal recovered in a crudely built homemade furnace at the Parks property lying north of the Kuskokwim River between Georgetown and the mouth of the Halitna River. None of the other deposits in the Kuskokwim Valley are believed to have done other than the annual assessment work required by law. Several test runs on mercury ore from a deposit at the head of Olive Creek in the Livengood region were made by J. B. Hudson and associates. Development work was continued by the Alaska Mercury Corporation in the vicinity of Bluff in the Seward Peninsula region. Ore carrying cinnabar has been found at several places along the northern front of the Alaska Range.

ARIZONA

In 1931 a large tonnage of ore was treated in the Gould rotary furnace at the Sunflower Mine of the Arizona Quicksilver Corporation, Maricopa County. New condensers were installed, and the other mill equipment of the plant was overhauled. The plant was put in operation on February 1, 1931, but on account of the drop in price of mercury was shut down on July 1. It is reported that A. E. Richardson purchased the properties of the Mercury Mines of America for $6,000 early in 1931 at a Federal marshal's sale. Development work was continued during the year at the Pine Mountain Mine of William Reynolds, Payson, and at the property of the Quicksilver Corporation of America, both in Maricopa County. Mercury mining in the vicinity of Lee's Ferry, under direction of the Spencer Mining Co. and the Treadwell Mining Corporation, Flagstaff, was discontinued early in the year owing to the absence of metal values sufficient to warrant further work.

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[5] Schuette, C. N., Recent Design of Quicksilver Plants: Eng. and Min. Jour., vol. 131, No. 7, Apr. 13, 1931, pp. 316–318. Limiting Factors in Quicksilver Metallurgy: Eng. and Min. Jour., vol. 132, No. 9, Nov. 9, 1931, pp. 398–400.

[6] Engineering and Mining Journal, Multiple Hearth Furnace Is Receiving More Attention for Roasting Quicksilver Ores: Vol. 132, No. 3, Aug. 10, 1931, pp. 127–129.

[7] Smith, P. S., Mineral Industry of Alaska in 1930: U. S. Geol. Survey Bull. 836–A, 1931, p. 81.

ARKANSAS

Discoveries of cinnabar occurrences in two localities, 15 miles apart, in Pike County, Ark., were reported in July, 1931.[8]

In eastern Pike County the discovery was made south of Nutt's Crossing about 5½ miles south of Amity and in western Pike County in sec. 1, T. 7 S., R. 26 W. The ore occurs in the Jackfork sandstone, but its genesis is not yet clearly established. The following quotation is taken from the article by Dr. Branner, already cited:

> Irrespective, however, of the conclusions which are reached relative to the origin, distribution, and value of the cinnabar on the Little Missouri River and on Antoine Creek, it is believed that, on account of the fact that the geology of the areas where the cinnabar is found is very similar to that which is found over an area of some 700 square miles in south Arkansas, the entire area in which the Jackfork, Atoka, and probably Stanley shale occur in Hot Spring, Clark, Pike, Howard and Sevier Counties should be carefully and systematically prospected for cinnabar. The location of these formations is shown on the map of this area.

The geology and developments in Arkansas were also described by Weigel.[9]

The Arkansas Quicksilver Co., Graysonia, reported an output of mercury in 1931 from two small retorts. The Southwestern Quicksilver Co., Leo. Yount, president, Murfreesboro, and Geo. Bell, Nashville, were engaged in active development work during the year. Other companies were engaged in prospecting and development work at the end of 1931 or early in 1932.

CALIFORNIA

The output of mercury in California in 1931 was 13,448 flasks, the largest for the State since 1919, when 15,005 flasks were produced.

Colusa County.—Mercury was produced at the Manzanita Mine by the Shanjay Quicksilver Mining Co. in 1931. This mine reverted to the Cinnabar Mining Co. at the end of the year and was subsequently leased to the Western Merger Mines Co. A 20-ton Newhall rotary furnace was installed during the year.

Contra Costa County.—The property of the Mt. Diablo Mining Co. was active in 1931.

Fresno County.—Mercury was produced at the Mercy Mine in 1931. Experimental work was carried on in a retort at the Archer Mine of Joseph Byles & Sons.

Inyo County.—William Symons, of Laws, produced mercury in 1931.

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[8] Branner, G. C., Cinnabar in Arkansas: Arkansas Gazette, Aug. 30, 1931.

[9] Weigel, W. M., New Quicksilver Discoveries: Eng. and Min. Jour., vol. 132, No. 11, Dec. 14, 1931, pp. 495–497.

Kern County.—The Cuddeback Mine near Keene was active until August 1, when it was shut down. Mercury was recovered in a Holmes continuous-feed retort by the Santa Ana Mining Co.

Kings County.—Some work was done by C. E. Linville at the Dawson Mine. The Segregation Mine, owned by C. F. Francis, was leased during the year to the Avenal Mining Co., and it was reported that the company expected to begin the production of mercury early in 1932.

Lake County.—The following mines contributed the mercury output of Lake County in 1931: Sulphur Bank, Mirabel, Great Western, Red Elephant, Anderson-Schwartz, Big Chief, Konocti, and Wilkinson.

The Sulphur Bank Mine, operated by the Bradley Mining Co., was by far the largest producer. The Bradley Mining Co. succeeded the Sulphur Bank Syndicate during the year. The methods of recovering the mercury at this property are described by Bradley.[10]

A new ore shoot was reported on the 300 level of the Mirabel Mine early in the year. The property is equipped with a 48-ton Scott furnace. A new 100-horsepower electric hoist was installed at the mine before the middle of the year.

E. J. Bumsted, formerly superintendent of the B. & B. Quicksilver Co., Esmeralda County, Nev., took over the Great Western Mine near Middletown in April, 1931. A new Herreshoff furnace was installed and in October production of mercury was begun. The chapter of this series for 1918 gives the following data regarding the Great Western Mine:

> Cinnabar in fractured radiolarian chert of the Franciscan group, near serpentine.—Shafts and tunnels 750 feet deep, with about 18,000 feet of drifts.—40-ton Litchfield furnace.—Production to the end of 1918, 101,275 flasks.—Abandoned; plant dismantled.

The output made by the Bumsted Mining Co. in 1931 was the first recorded since 1915, when a small quantity of mercury was produced from old dumps.

The Red Elephant Mine was closed in May. Mercury was produced from experimental work being carried on in the Newhall rotary furnace at the Big Chief Mine. Mercury was produced in 1931 by Wilkinson Bros., Middletown, chiefly as a result of development work. Only high-grade ore was saved, but a small concentrator was being installed early in 1932 to treat the low-grade material.

Prospecting and development were carried on at other properties in the county.

Monterey County.—A small quantity of mercury was produced at the Patriquin Mine in 1931.

Napa County.—Mercury was produced in Napa County in 1931 by the following mines: La Joya, Oat Hill, Bella Oak, Knoxville, Mt. St. Helena and Ivanhoe, and Aetna.

The mercury output of the Oat Hill Mine, operated by the Acme Mines & Mill (Inc.) was larger in 1931 than in 1930. The Acme Mines & Mill (Inc.) held the property under option until January 1, 1932, when it was relinquished to H. W. Gould & Co. The development early in 1931 of a new ore shoot at the Lucky Strike Mine, operated by the Lucky Strike Mining Co., permitted resumption of furnace operations at this property late in April. Production at the Knoxville

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[10] Bradley, Worthen, Method and Cost of Recovering Quicksilver from Low-Grade Ore at the Reduction Plant of the Sulphur Bank Syndicate, Clearlake, Calif.: Inf. Circ. 6429, Bureau of Mines, 1931, 17 pp.

Mine, owned and operated by Geo. E. Gamble in 1931, was made in a 3 by 40 foot Gould rotary furnace. Two small retorts were used for treating mercurial soot and flue dust. H. W. Gould & Co. operated the Bella Oak Mine in 1931 for the Bella Oak Mines Co., Napa, lessee. The mine reverted to the owners, MacDonald Estate, in the latter part of 1931, and the Bella Oak Mines Co. was disbanded. The Aetna Mine was operated by D. L. Llewellyn in 1931. The production was entirely from old dumps treated in a 100-ton Gould rotary furnace. Soot from the furnace was treated in a small retort. Harry E. Patten, Calistoga, operated the Mt. St. Helena and Ivanhoe Mines during 1931. Considerable development work was done.

San Benito County.—According to a short news article in the Nevada Mining Press of May 8, 1931, four 100-ton Gould rotary furnaces were in operation at that time at the New Idria Mine. This news item gave the production for April as 500 flasks, a record monthly output for recent years. Tom Bosanko and C. D. Richardson are reported to have located some claims on an extension of the New Idria ore body. Arthur Turpen was in charge of operations at the Aurora Mine part of the year, and a quantity of mercury was produced. Assessment work was done at the Bitterwater Mine, leased by Turpen during the year. In addition to the mines already mentioned the Stayton Mine of R. B. Knox, the Black Hawk Mine of Silvestre Tirado, and one or two others in San Benito County also produced mercury in 1931.

San Bernardino County.—Development work was carried on at the New Idria group of claims located about 4½ miles from Goffs, Signal district, by Frank Chausse. E. B. Maginnis and A. B. Day did exploratory work at their Bimetallic Mine in the Rand district 4 miles northeast of Johannesburg. In addition to mercury, gold, silver, and tungsten are said to be present in the ore. The owners report a large quantity of ore in sight averaging ¼ to 1 per cent mercury.

San Luis Obispo County.—A large quantity of mercury was produced at the Oceanic Mine in 1931 by the Consolidated Metals Corporation. Press reports published in May, 1931, indicated that output at that time was about 150 flasks a month. In October efforts were being made to increase the output to 170 flasks a month; and a statement was made by H. W. Klipstein, president of the company, that, based on this rate of production, seven years' supply of ore was in sight. Ore taken from the mine averaged about 5½ pounds of mercury to the ton.

The Alamo Mercury Co. produced mercury in a small retort at the Deer Trail Mine 35 miles from San Luis Obispo. A small quantity was also produced at the Carson (Klau) Mine by a caretaker. Only assessment and development work was done at the Capitola and Santa Monica Mines, also owned by E. W. Carson. In April, 1931, H. W. Gould & Co. obtained bond and lease on the Mahoney Mine which adjoins the Carson (Klau) Mine. Considerable development work was done during the year, and a Gould rotary furnace may be installed later. A rotary furnace was installed at the Rinconada Mine of the Mercury Corporation of America near Santa Margarita, and a much larger quantity of mercury was produced in 1931 than in 1930. A small quantity of mercury was produced by the Little Bonanza group of mines near Adelaida, where a 25-ton rotary furnace was installed during the year.

Santa Barbara County.—Mercury was produced by the Los Prietos Quicksilver Mines Co. in 1931. Early in the year press reports stated that a large body of cinnabar had been located by the company. During the latter part of the year, however, the mine was shut down.

Santa Clara County.—Mercury was produced from the treatment of dump material at the New Almaden Mine by B. Black in 1931, as in 1930.

Siskiyou County.—The Horse Creek Cinnabar Co. reported large reserves of cinnabar ore at its property on the Klamath River. No work was done in 1931, but the company expected to produce in 1932. Eugene Aureguy produced mercury from the Great Northern Mine 20 miles west of Hornbrook.

Solano County.—At the St. Johns Mine near Vallejo prospecting was done and an old Scott furnace remodeled.

Sonoma County.—The Nevada Quicksilver Mines (Inc.) produced mercury at the Cloverdale Mine in 1931. Considerable exploration and development work was done at the Cloverdale and Baumeister (Buckeye) Mines during the year, and satisfactory showings of ore were reported. Option on the Baumeister Mine, however, was abandoned in the latter part of the year. Mercury was also produced in 1931 from the following mines in Sonoma County: The Socrates, 20 miles from Healdsburg, by Fred Bender; the Skaggs Springs, by Chas. Cavagnaro; the Culver Baer, 21 miles from Healdsburg, by Camp Calso Co.; and the Esperanza, 14 miles east of Cloverdale, by J. K. Harrison. The Esperanza Mine reverted to the owner, Geo. T. Pomeroy, in January, 1932. A large quantity of low-grade ore is available at the Great Eastern Mine near Guerneville. There are two Scott furnaces of 20 tons capacity each and two D retorts at this mine, but the property is idle because the ore is too low grade to pay the cost of production. Through 1918 the Great Eastern Mine had a recorded production of 43,500 flasks. Prospecting was done 20 miles from Healdsburg by J. E. Grover and 12 miles east of Cloverdale by L. D. Kissack.

Trinity County.—In Trinity County mercury was produced at the Altoona Mine 24 miles west of Castella by J. A. Larson and at the New River Mine in the New River district by E. T. Haun. The Altoona Mine is described in a report issued early in 1931.[11]

NEVADA

The output of mercury in Nevada in 1931 was 2,217 flasks, a decrease of 32 per cent from production in 1930, which in turn was 31 per cent lower than in 1929.

Elko County.—The Mayflower and Wild Horse Mine of F. R. Bowers in the Ivanhoe district near Midas was leased to Geo. A. Newhall & Co. in 1930 and 1931 but reverted to the owner on July 1, 1931. A substantial production was made. Work was carried on by the owner after July 1, and a considerable amount of ore was reported to be blocked out.

Esmeralda County.—Mercury was produced in Esmeralda County in 1931 by the B. & B. Quicksilver Co. and by lessees and owners of the Red Rock group of mines. The B. & B. Quicksilver Co. operated from January to June and early in 1932 was reported as out of business.

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[11] California State Mining Bureau, Mining in California: January, 1931, pp. 63–64.

Several lessees and the owners operated the Red Rock group of mines in 1931. At the end of the year J. L. McKinney, a former part owner, was operating the property under lease. Some prospecting and development work was carried on at a hot-water deposit of cinnabar ore near Cuprite, 14 miles south of Goldfield, by Geo. Smith, William Beyers, and Joseph Fuetsch.

Humboldt County.—Press reports stated that in 1931 the Bradley Mining Co. (formerly Mercury Mining Syndicate) optioned the McCormick mercury mine on Buckskin Mountain 75 miles north of Winnemucca and near the Oregon border to develop an additional supply of ore for its Opalite furnace. The Opalite Mine and plant are in Oregon near the Nevada line. It was reported that work at the McCormick property was suspended in August.

Mineral County.—Several operators reported the output of small quantities of mercury in the vicinity of Mina and Mt. Montgomery in 1931. The Mammoth Quicksilver Mining Co., Noble C. Smith, Mina, reported the expenditure of $25,000 during the year in new development work and in the installation of furnace, trams, etc. The new plant, having a capacity of 10 tons a day, was completed late in December. The property operated by the Mammoth Quicksilver Mining Co. is the Easter group of claims formerly operated by Cornelius and Mace. Operations were carried on at the Red Rose Mine near Mt. Montgomery by the Mt. Montgomery Quicksilver Co., L. W. Whiting, president and general manager. Difficulty in financing prevented the installation of a furnace. Mr. Whiting died suddenly late in the year, and the firm went out of business.

Nye County.—James G. Cortelyou and B. I. Potter took over the Nevada Quicksilver Mine in the Ione district, Nye County, to be operated as "Bonita Mines." A new Herreshoff furnace, with a rated capacity of 80 tons a day, was purchased and early in 1932 the operators reported that installation of the furnace was awaiting the opening up of the roads. Mercury was produced at the Sentinel Mine of the Raymond Van Ness Mining Co. It is reported that at the 100-foot level the ore averaged 6 to 8 pounds of mercury to the ton. Financial difficulties caused a shutdown late in the year, but it is reported that the stockholders of the company were successful in refinancing the company at a meeting held on February 6, 1932.

Pershing County.—In the Antelope Springs district in 1931 mercury was produced by the Antelope Springs Mercury (Inc.) and the Nevada Quicksilver Mines (Inc.). The Pershing Quicksilver Co. was idle during the year. The new 20-ton rotary furnace of the Antelope Springs Mercury (Inc.), designed by C. N. Schuette, was put in operation during the week of December 5, 1930; it was closed in May, 1931, and was reported reopened in July on a 50 per cent basis. Operations at the plant of the Nevada Quicksilver Mines (Inc.) were intermittent during the year. Early in 1931 it was reported that exploratory work chiefly was being done but that as the bunkers became filled with ore the furnace was started, continuing until the ore was used up. The Juniper Mine was leased to Hunley & Forge late in the year. Exploration work was carried on by Henry & Olesen at Bunker Hill claim No. 2, Antelope Springs district. A 20-ton Newhall furnace was installed at the Cinnabar King Mine and was put in operation on April 28. The Cinnabar King Mine is 42 miles from Lovelock and 17 miles from Oreana in American Canyon.

It was reported that the plant was closed temporarily in November owing to the low price of mercury.

Storey County.—The Castle Peak Mine was the largest mercury-producing property in Nevada in 1931. Some very rich ore was reported during the year on the mill tunnel level 110 feet below the bottom of the glory hole and adjoining stope. Another rich strike was made 110 feet below the mill tunnel on the slope of the vein. The high-grade ore mined during the year was mixed with lower-grade ore from the upper workings for treatment in the 35-ton electrically operated furnace. During the first three quarters of the year the mine produced 618 flasks of mercury. The plant was closed during part of the last quarter; consequently, the output for that quarter was lower than the average for the preceding three. From December, 1929, through 1931 the company paid $53,385 in dividends.

OREGON

The output of mercury in Oregon in 1931 was the largest ever recorded for the State and amounted to 5,011 flasks, an increase of 72 per cent over production in 1930. Considerable prospecting and development were done near Prineville, Crook County, and near Sutherlin, Douglas County; but most of the production was from the Black Butte Mine 17½ miles south of Cottage Grove, Lane County, and the Bretz and Opalite Mines in southwestern Malheur County.

Crook County.—It was reported late in the year that a new company headed by A. A. Aya had begun development work in the Platna Mine near Prineville under a sublease on the property. During the year a retort was installed at the mine of the Blue Ridge Mercury Co.; it was put in operation in August, and some mercury was produced. A vein of 1 per cent ore 4 to 5 feet wide has been reported at the Cinnabar Mines Corporation property near Ochoco. Prospecting was carried on at the property of the Independent Quicksilver Co. southeast of Prineville. The new condensers installed by the Johnson Creek Mercury Co. are reported to have increased greatly the recovery at the reduction plant at its mine south of Prineville. The company was involved in litigation at the end of the year, and the property was idle. A large deposit of high-grade ore is reported uncovered at the mine of the Maury Mountain Mining Co. 35 miles southeast of Prineville. At the end of the year it was reported that equipment for a 20-ton furnace was at the mine and that erection of the plant would be completed early in 1932. Installation of a reduction plant was reported at the mine of the Sunset Mining Co., Lakeview.

Douglas County.—Development work was carried on at the Elkhead and Bonanza Mines 24 and 8 miles, respectively, from Sutherlin, by the Elkhead Quicksilver Mining Co. and the Northwestern Quicksilver Co., both companies under the management of J. W. Wenzel. It is reported that a contract for a 100-ton furnace was let by the Elkhead Quicksilver Mining Co. in January, 1932. A 10-foot 4-hearth Nichols-Herreshoff furnace was reported installed at the Non Pareil Mine 8 miles east of Sutherlin. The plant has a centrifugal cast-iron condensing system and two large redwood gas washers of a new design and can treat 25 to 30 tons of ore daily. The new furnace did not begin operation until the spring of 1932.

Lane County.—Two rotary furnaces were in operation during the year at the Black Butte Mine of the Quicksilver Syndicate 17½ miles south of Cottage Grove. This mine was one of the largest producers of mercury in the country in 1931. In September it was reported that 43 men were employed at the property and that 80 tons of ore a day were being handled.

Malheur County.—The Bradley Mining Co., formerly the Mercury Mining Syndicate, optioned the Bretz Mine near McDermitt, Nev., but across the border in Malheur County, Oreg., and produced ore by power shovel, tractor, and scraper. The ore was shipped to the Opalite reduction works for treatment. In August it was reported that 50 to 60 tons of ore a day from this property were being treated. Treatment of condenser residues at Opalite are described in an article in the Engineering and Mining Journal.[12]

TEXAS

There was increased activity in Texas in the development of mercury properties in 1931, and production was considerably higher than in 1930. All three principal producers in the State participated in this increased output. As in the past, the total production was from the Terlingua district, Brewster County.

The Brewster Quicksilver Co. produced a large quantity of mercury at the Big Bend Mine and a negligible amount at the Texas Almaden property. It was estimated early in 1932 that approximately 20,000 tons of ore were blocked out at the Big Bend Mine, a quantity approximately equivalent to the tonnage extracted during the year. Of the ore mined, however, less than 8,000 tons were treated in the 30-ton rotary furnace and 12-tube Johnson-McKay retort. The ore mined averaged 0.188 per cent mercury and that treated, 0.545 per cent. Furnace efficiency and costs at the Brewster plant are described by Schuette.[13] The Chisos Mining Co. increased the output from the Chisos Mine. More mercury was produced by the Rainbow Mines (Inc.) in 1931 than in 1930. A 10 to 15 ton Herreshoff furnace was put into operation at the Rainbow Mine in January, 1931. E. A. Waldron resumed work during the year; it consisted principally of testing ore from different properties. About 14 flasks of mercury were produced in a D retort as a result of the experimental work. Frank Duncan continued exploration and development work at his property.

UTAH

During 1931 the Sacramento Gold & Quicksilver Mining Co. was organized to take over bond and lease on 10 patented claims of the Sacramento group at Mercur, Tooele County. The company is reported to own 39 adjoining claims said to have large tonnages of low-grade gold ore and cinnabar ore. Press reports state that flotation experiments were being made on the mercury and gold dumps. Later it was reported that the International Smelting Co. had taken option for a controlling interest in the Sacramento Gold & Quicksilver Mining Co.

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[12] Engineering and Mining Journal, Furnacing Quicksilver Condenser Residues: Vol. 133, No. 2, February, 1932, p. 88.

[13] Schuette, C. N., Dust-Collecting Efficiency Increased in Quicksilver Reduction Plants: Eng. and Min. Jour., vol. 133, No. 4, April, 1932, pp. 236–237.

WASHINGTON

Mercury was produced in Lewis County in 1931 by the following companies: Charlotte Ann Mercury Co., Consolidated Mercury Mining Co., Dawson Quicksilver Mining Co., and Washington Cinnabar Co. Operations at the Charlotte Ann and Dawson Mines were new. The production at each mine was made in a small retort. The Consolidated Mercury Mining Co. produced 441 flasks of mercury from the treatment of 11,115 tons of ore at the Barnum-McDonell Mine. It was reported that a large tonnage of ore was blocked out. The Washington Cinnabar Co. reported that it purchased the Fisher (Morton) Mine from the receiver of the Fisher Mercury Co. in July, 1931. Treated ore totaled 1,581 tons averaging 0.25 per cent mercury. According to reports a large tonnage of ore was blocked out. Early in 1932 the company reported that it would be unable to operate profitably if mercury prices were any lower. The Research Engineering Corporation reported that it had installed a continuous-feed retort of its own design to treat daily 12 tons of concentrate from the Morton dump. The Tacoma Cinnabar Co. was reported at the end of the year to be completing installation of a Coleman retort of 10 tons daily capacity.

Development work was carried on in the Leavenworth mining district, Chelan County, by the Shoshone Mercury Co. Nowlan & Olds are prospecting on a near-by property.

WORLD PRODUCTION

World production of mercury, 1927–1931, by countries

[Compiled by L. M. Jones, of the Bureau of Mines]

[1 metric ton=29.008 flasks of 76 pounds]

Country [1]	1927		1928		1929		1930		1931	
	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons
Algeria	29	1.0	--------	--------	122	4.2	325	11.2	(2)	(2)
Austria	160	5.5	133	4.6	113	3.9	72	2.4	72	2.5
Bolivia [3]	--------	--------	46	1.6	49	1.7	--------	--------	1,021	35.2
China	[4] 2,147	[4] 74.0	[5] 1,973	[5] 68.0	[5] 1,973	[5] 68.0	[5] 1,973	[5] 68.0	[3] 3,295	[3] 113.6
Chosen	--------	--------	--------	--------	15	.5	26	.9	(2)	(2)
Czechoslovakia	1,601	55.2	2,086	71.9	1,897	65.4	2,060	71.0	2,222	76.6
Italy	57,900	1,996.0	57,677	1,988.3	57,966	1,998.3	56,069	1,932.9	37,652	1,298.0
Japan	--------	--------	14	.5	41	1.4	121	4.2	(2)	(2)
Mexico	2,353	81.1	2,535	87.4	2,396	82.6	4,821	166.2	7,292	251.4
New Zealand	20	.7	--------	--------	--------	--------	52	1.8	450	15.5
Rumania	104	3.6	--------	--------	--------	--------	--------	--------	(2)	(2)
Russia [6]	2,147	74.0	2,950	101.7	3,771	130.0	3,278	113.0	(2)	(2)
Spain	72,316	2,493.0	63,675	2,195.1	71,832	2,476.3	19,221	662.6	19,786	682.1
Turkey	--------	--------	124	4.3	235	8.1	537	18.5	235	8.1
United States	11,128	383.6	17,870	616.0	23,682	816.4	21,553	743.0	24,947	860.0
	149,905	5,167.7	149,083	5,139.4	164,092	5,656.8	110,108	3,795.7	(2)	(2)

[1] In addition to the countries listed Taiwan reports production of 27,979 kilograms of cinnabar in 1929. Mercury content not stated.

[2] Data not available.

[3] Exports.

[4] Production as reported by Geological Survey of China.

[5] Approximate production (Imp. Inst., London).

[6] Year ended Sept. 30.

FOREIGN SOURCES

ALGERIA

French hopes to become independent of foreign sources of mercury are nearer realization with the solving of certain metallurgical difficulties in the treatment of the ore from the Department of Constantine, Algeria. A Ras-el-Ma mining company (capitalized at 3,600,000 francs) was organized in 1926 to exploit this ore, which is said to average around one-half per cent; but little production resulted until late in 1930, when a furnace plant was completed. This plant is variously described as handling 120 tons of ore daily and as supplying 2,500 flasks of metal yearly, or about 40 per cent of French requirements. Increased capital is said to have been furnished to increase the output to more than 4,000 flasks, and early in 1932 the French Government took steps to safeguard the market in the mother country by limiting imports from foreign countries. Preliminary reports indicate a production of 37.5 metric tons of metal in 1931 from 20,880 tons of crude ore, a yield of only 0.18 per cent.

AUSTRALIA [14]

The cinnabar deposits near Kilkivan in Queensland were examined by Government geologists in June, 1931. At the Commotion lode there appeared to be a fairly substantial tonnage of low-grade ore averaging (over a length of perhaps 250 feet and a width of 1 foot) 0.215 per cent mercury. Considerably richer ore occurs in the Bloodworth lode where further development seems indicated. At the old Central workings in the same group, where rich ore was extracted 40 years ago, trenching has failed to reveal any continuation of the ore shoots. The Commotion-Central-Bloodworth occurrences (about 5 miles west of Kilkivan and 2½ miles from railroad) are in coarsely crystalline biotite granite on the northerly slope of a low ridge which roughly outlines the southern boundary of the granite where it adjoins a porphyritic andesite. Diorite dikes have intruded the granite. The Wolf lodes (about 7 miles south-southwest of Kilkivan) occur in a series of interbedded shales, sandstones, tuff, and volcanic conglomerate; samples taken at accessible points in and near the old workings assayed too little mercury to warrant further expense in reopening the mine. The earlier history of these fields is recorded in Publications 28 and 79 of the Geological Survey of Queensland and in the Queensland Government Mining Journal of December, 1914. From 1874 to 1892 about 13,700 pounds of mercury were produced in the Kilkivan district, according to a statement of the Imperial Mineral Resources Bureau.

CHILE [15]

According to a Reuter report large mercury deposits have been discovered in the Province of Atacama on the Capiapo River about 30 miles from its mouth, near deposits of lapis lazuli.

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[14] Dunstan, B., and Ridgway, J. E., The Mercury Deposits near Kilkivan: Queensland Govt. Min. Jour., vol. 32, No. 375, Aug. 15, 1931, pp. 311-315.

[15] Metallbörse, Neue Quecksilbervorkommen in Chile: Jahrg. 21, No. 46, Berlin, 1931, p. 1087.

FRANCE

A description[16] of an occurrence of mercury near Montpellier, Hérault, in the south of France, is of scientific interest. The metal occurs in conglomerates (Pliocene) in spherical drops accompanied by calomel; in underlying marine sands only calomel is present.

ITALY

In 1931 the production of mercury in Italy dropped sharply to 37,652 flasks (1,298 tons), compared with 56,069 flasks (1,932.9 tons) in 1930; stocks increased. Monte Amiata alone is credited with holding about 50,000 flasks, whereas its annual quota under the new agreement between the cartel and the Roura & Forgas firm was only 6,000 flasks. This leading property, which is controlled by the Government, was operating only three days a week near the close of the year with a force of 1,300 men.[17] All the smaller properties owned by this concern were closed, and preparations were being made to curtail operations further at the principal mine at San Salvatore. A large reduction in operations was also contemplated at Idria.

Mercury produced in Italy, 1929 and 1930

Province	Ore mined						Metal produced				
	Number of mines	Number of workmen	Metric tons	Tenor (per cent)	Value [1]	Tons per man	Number of plants	Number of workmen	Flasks (76 pounds)	Value [1]	Flasks per man
1929											
Gorizia (Trieste)	1	821	79, 635	0. 674	$1, 076, 079	97. 00	1	132	13, 129	$1, 347, 518	99. 46
Grosseto	10	534	49, 799	. 400	365, 960	93. 26	4	181	5, 665	561, 956	31. 30
Roma	1	11	117	. 600	1, 010	10. 64	------	------	--------	----------	-------
Siena	6	1, 065	110, 080	1. 237	3, 341, 338	103. 36	3	463	39, 172	3, 886, 893	84. 60
	18	2, 431	239, 631	. 884	4, 784, 387	98. 57	8	776	57, 966	5, 796, 367	74. 70
1930											
Gorizia (Trieste)	1	811	78, 014	. 698	1, 107, 281	96. 19	1	131	12, 752	1, 327, 769	97. 34
Grosseto	4	538	56, 512	. 450	441, 004	105. 04	4	163	6, 721	673, 597	41. 23
Siena	4	942	108, 612	1. 140	3, 003, 499	115. 30	3	456	36, 596	3, 667, 019	80. 25
	9	2, 291	243, 138	. 838	4, 551, 784	106. 13	8	750	56, 069	5, 668, 385	74. 76

[1] Lire converted to dollars at the average annual rate of exchange, as published by the U. S. Federal Reserve Board.

MEXICO

The revival in mercury mining in Mexico continued in 1931 on an expanding scale; the output increased to 7,292 flasks, compared with 4,821 flasks in 1930 and a maximum of around 10,000 flasks in 1898. Formerly, Mexican mercury was shipped mainly to the United States, but in 1931 by far the bulk of it had to be marketed in Europe.

In the official Boletin Minero for July–December, 1931, seven mercury properties were listed as active and eight as inactive (or not reporting). Of the active mines four were in the State of Guerrero and one each in the States of Chihuahua, Zacatecas, and Jalisco. According to a comprehensive résumé in the same journal for May, 1931 (pp. 134–137), production may be expected to increase if prices are not too drastically reduced. Under the Spanish régime mercury mining was prohibited; subsequently the industry has developed slowly because most of the deposits have been more or less isolated and inaccessible, a condition aggravated further by political uncertainties and periods of low prices for the metal.

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[16] Royer, M. L., Sur la Présence du Mercure dans les Environs de Montpellier (Hérault): Soc. franç. Miner., Bull. 53 (7–8), November-December, 1930 (1931), pp. 519–524; Annotated Bibliography of Economic Geology for 1931: Vol. 4, No. 1, January, 1932, p. 60.

[17] Metal and Mineral Markets, German Consumption of Metals Declined in 1931: Vol. 3, No. 5, Feb. 4, 1932, p. 5.

About two-thirds of the Mexican output (in 1929, at least) came from Guerrero. Most of the deposits in this State are situated in a zone north of the Balsas River and extend practically to the borders of the States of Michoacán, Mexico, Morelos, and Puebla. Another and apparently disconnected occurrence is found some distance south of the Balsas River in the central part of the State near Quechultenango, a little town south of Chilapa.

NEW ZEALAND

After several years of more or less active development the mercury mines at Ngawha Springs near Kaikohe in the northern peninsula of North Island appear to have been abandoned. Furnace equipment was installed in 1930; but only a little over 50 flasks of metal were actually shipped in that year, and the total output probably was not very large. According to press reports, however, 221 flasks were shipped to England from New Zealand in the latter part of 1931, possibly out of stock. Early in 1932 it was reported that all employees had been discharged and that the plant was to be dismantled. Difficulty in making a commercially pure metal and declining prices were mentioned among other troubles leading to the failure of the project.

RUSSIA

Mercury is still produced in Russia only at Nikitovka in the Donetz (Donbass) Basin in the Ukraine, where new equipment has been installed to speed up production, which for several years has remained around 3,000 flasks annually—not enough for Russian needs. Equipment for substantial enlargement of the present German-built plant at this property was ordered in 1931, and estimates of ultimate capacity run as high as 20,000 flasks or more a year. The Khaidarkan Mine in Turkestan is also scheduled for active exploitation. G. C. Riddell, a well-known American engineer, is in charge of these and other projects directed by the Soyuzredmet (Rare Metal Trust). Mercury deposits in Tadzhikistan between Ferghana and the Alai Mountains south of Tashkent were said to have been worked by the Chinese in the eighth and ninth centuries. Estimates of reserves show some 8,000 tons at Ferghana and 18,000 tons at Khaidarkan—probably in terms of total metal content. Discoveries of ore containing as much as 6 per cent mercury have been reported over a distance of 16 kilometers.

SPAIN

The famous Almadén Mine is credited with the ability to produce 60,000 flasks or more of mercury annually at a cost of less than $15 a flask, whereas costs average roughly double this figure for 25,000 flasks. These cost estimates, quoted from a recent article in the

Mining Journal of London,[18] are only a fraction of the estimates made a few years ago and evidently reflect the vigorous efforts to modernize the plant and lower costs. Other recent estimates run as high as $45 a flask, but even this figure represents a reduction compared with former years. The article, however, mentions that certain restrictions on working conditions are still in force which tend largely to inflate costs at this high-grade property. Monthly wages are fixed at 250 pesetas, but instead of working underground steadily each man works only eight 6-hour shifts in the mines during a 3-month period and spends the remainder of his time in the woods. Now that mercury poisoning around mines and plants can be virtually prevented such precautions are unnecessary. An additional handicap in this State-owned enterprise is the fact that it is not possible to reduce the number of employees in proportion to the drastic curtailment in output that has resulted from the agreement with Italy and the subsequent collapse of world demand.

In addition to the famous Almadén Mine in the Province of Ciudad Real there are three mines in the Alpujarras in the Province of Granada. The output of these mines and sporadic contributions from the north of Spain are not believed to be controlled by the Spanish Government or by the cartel.

Mercury produced in Spain, 1929 and 1930

Province	Ore mined						Metal produced				
	Number of mines	Number of workmen	Metric tons	Tenor (per cent)	Value [a]	Tons per man	Number of plants	Number of workmen	Flasks (76 pounds)	Value [a]	Flask per man
1929											
Ciudad Real	1	480	34,666	5.74	$870,409	72.22	1	410	71,562	$5,252,392	174.54
Granada	3	30	1,612	.95	8,998	53.73	1	21	270	24,619	12.86
	4	510	36,278	5.53	879,407	71.13	2	431	71,832	5,277,011	166.66
1930											
Ciudad Real	1	480	18,000	4.52	359,110	37.50	1	410	18,937	1,104,429	46.19
Granada	3	30	1,740	.95	11,369	58.00	1	21	284	20,503	13.52
	4	510	19,740	4.21	370,479	38.71	2	431	19,221	1,124,932	44.60

[a] Pesetas converted to dollars at the average annual rate of exchange, as published by the U. S. Federal Reserve Board.

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[18] American Metal Market, Almadén and the Quicksilver Cartel: Vol. 38, Sept. 10, 1931, p. 3.

LEAD AND ZINC PIGMENTS AND SALTS[1]

By E. W. Pehrson[2]

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SUMMARY

The total value of lead and zinc pigments sold by domestic producers amounted to approximately $56,267,000 in 1931 as compared with $69,253,000 in 1930, a decrease of 19 per cent. Sales of lead pigments decreased 20 per cent in value and amounted to 52 per cent of the total value, whereas sales of zinc pigments declined 17 per cent and amounted to 48 per cent of the total.

The quantity of lead pigments sold by producers in 1931 amounted to 197,079 short tons, a decrease of 22,463 tons (10 per cent) as compared with 1930 and 98,381 tons (33 per cent) compared with 1929. Each of the lead pigments shared in this decrease; sales of white lead (dry and in oil) decreased 5 per cent; litharge, 12 per cent; red lead, 22 per cent; basic lead sulphate, 16 per cent; and orange mineral, 21 per cent.

The quantity of zinc pigments sold by producers in 1931 amounted to 266,127 short tons, a decrease of 34,359 tons (11 per cent) as compared with 1930 and 127,948 tons (32 per cent) compared with 1929. Sales of zinc oxide and lithopone fell off 20 and 7 per cent, respectively, in 1931 as compared with 1930, but sales of leaded zinc oxide increased 8 per cent.

Sales of zinc chloride increased 20 per cent in 1931, whereas sales of zinc sulphate declined 15 per cent.

According to reports submitted to the Bureau of Mines, the lead and zinc pigment industry is not burdened with excessive stocks. During 1931 production closely approximated consumption. Sales of all pigments except three exceeded the quantity produced by 2 to 8 per cent. The three exceptions were dry white lead, litharge, and lithopone, and in each case sales amounted to more than 95 per cent of the total production.

The marked decline in the pigment industry in 1930 and 1931 reflected the sharp curtailment in the manufacture of paint, storage batteries, and rubber brought about by the general business depression. In previous periods of unemployment some paint-pigment manufacturers actually enjoyed substantial increases in sales, as many idle workers painted their homes while unemployed. In 1921 the sales of white lead in oil increased 28 per cent over those in 1920. At the beginning of 1930 a similar increase was expected, but the record now shows that in this respect 1930 and 1931 were exceptional years.

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[1] Work on manuscript completed June, 1932.

[2] Statistics in this report prepared (unless otherwise indicated) by H. M. Meyer and data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

Market quotations for all lead pigments in 1931 suffered declines that ranged from ¾ cent to 2 cents per pound. Prices of the white pigments were maintained at the same level during the first 11 months, but in December price cuts amounting to about 10 per cent were announced. Prices of the red oxides responded to fluctuations in the pig-lead market. A net decline of 2 cents per pound was recorded for litharge and red lead. The average value per ton of lead pigments in 1931, as reported by producers to the Bureau of Mines, was only 11 per cent below the average in 1930, whereas the average quoted price of lead (New York) declined 23 per cent. Quotations on zinc oxide and leaded zinc oxide were maintained at the levels of the four preceding years, although the price of slab zinc (St. Louis) was 20 per cent lower in 1931 than in 1930. Lithopone prices were maintained at the quotations prevailing at the close of 1930.

Foreign trade in pigments fell off considerably during 1931. Imports of all lead and zinc pigments amounted to 7,278 tons, valued at $648,733, a decrease of 13 per cent in quantity and 19 per cent in value. Exports totaled 17,047 tons, valued at $2,005,638 (32 per cent below the amount and 40 per cent below the value of exports in 1930). Imports of lead pigments were negligible. Lithopone, the principal zinc pigment imported, and zinc sulphide showed declines, but incoming shipments of zinc oxide increased. Exports of all lead and zinc pigments except lithopone decreased.

An outstanding feature of the lead and zinc pigment industry during the last few years has been the severe competition between white lead and other pigments for the paint trade. The effect of this competition is indicated roughly in the comparative sales of the pigments concerned. Sales of white lead in oil decreased from 153,000 tons in 1922 to 70,000 tons in 1930. During the same period the combined sales of zinc oxide and lithopone increased from 212,000 to 283,000 tons. As three-fourths of the lithopone and about one-third of the zinc oxide produced in the United States are used in the manufacture of paints these figures indicate the marked degree to which the zinc pigments have invaded the paint industry at the expense of white lead. This trend, however, appears to have been reversed in 1931, as sales of white lead to the paint industry increased slightly, whereas the consumption of lithopone in paint decreased over 5 per cent and the total sales of zinc oxide decreased 20 per cent.

During the year two new plants for the production of lithopone and zinc oxide began operations. The producing organization of one large pigment manufacturer was completely reorganized to increase efficiency and effect economy. Many plants operated on a sharply curtailed basis, and others shut down completely. Some plants were permanently abandoned.

PRODUCTION

In this report sales of pigments and salts are considered as representing the production, no account being taken of the stocks on hand at the beginning and end of the year. The amounts used by producers at their own plants are included under sales.

The total value of lead and zinc pigments sold by domestic producers was approximately $56,267,000 in 1931 as compared with $69,253,000 in 1930. The total value of all lead pigments sold was $29,128,410, and that of all zinc pigments sold was $27,138,450. Sales of lead pigments decreased 20 per cent in total value and 10 per cent in quantity, whereas sales of zinc pigments decreased 17 per cent in total value and 11 per cent in quantity. The average value per ton of lead pigments sold in 1931, as reported by producers, declined only 11 per cent, whereas the average New York quotation for pig lead declined 23 per cent in 1931 as compared with 1930. Zinc pigments declined only 6 per cent in value per ton, as compared with a 20 per cent decrease in the St. Louis quotation for slab zinc.

Sales of zinc chloride increased 20 per cent in quantity and 14 per cent in value in 1931, whereas sales of zinc sulphate decreased 15 per cent in quantity and 28 per cent in value.

The following tables show the sales of lead and zinc pigments and zinc salts from 1927 to 1931, as reported to the Bureau of Mines:

Lead pigments sold by domestic manufacturers in the United States, 1927–1931, in short tons

Year	White lead		Basic lead sulphate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1927	38,669	119,026	13,482	1,061	39,073	709	81,655
1928	42,049	111,923	16,002	1,234	40,497	459	85,570
1929	42,159	104,872	15,580	1,234	43,021	678	87,916
1930	32,548	69,592	10,308	1,219	32,941	356	72,578
1931	30,922	66,446	8,790	896	25,853	282	63,890

Lead pigments sold by domestic manufacturers in the United States, 1930 and 1931

Pigment	1930			1931		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Basic lead sulphate or sublimed lead:						
White	10,308	$1,321,339	$128	8,790	$995,685	$113
Blue	1,219	130,017	107	896	90,755	101
Red lead	32,941	5,066,297	154	25,853	3,325,875	129
Orange mineral	356	76,655	215	282	55,254	196
Litharge	72,578	9,713,765	134	63,890	6,933,241	109
White lead:						
Dry	32,548	4,572,648	140	30,922	3,824,813	124
In oil	69,592	15,505,196	223	66,446	13,902,787	209

Zinc pigments and salts sold by domestic manufacturers in the United States, 1927–1931, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° B.)	Zinc sulphate
1927	151,246	26,064	176,994	40,141	6,418
1928	160,904	24,223	200,468	45,669	4,733
1929	160,611	27,149	206,315	43,189	7,454
1930	119,142	17,279	164,065	29,043	6,249
1931	95,700	18,577	151,850	34,885	5,290

Zinc pigments and salts sold by domestic manufacturers in the United States, 1930 and 1931

Pigment or salt	1930			1931		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide [1]	119, 142	$14, 896, 883	$125	95, 700	$11, 997, 996	$125
Leaded zinc oxide [1]	17, 279	2, 072, 197	120	18, 577	2, 140, 864	115
Lithopone	164, 065	15, 897, 683	97	151, 850	12, 999, 590	86
Zinc chloride, 50° B	29, 043	1, 247, 385	43	34, 885	1, 417, 010	41
Zinc sulphate	6, 249	276, 728	44	5, 290	199, 482	38

[1] Zinc oxide containing 5 per cent or more of lead is classed as leaded zinc oxide.

Statistics for lead arsenate, lead acetate, zinc stearate, and other lead and zinc salts and compounds are collected biennially by the Bureau of the Census for odd years. Details of production for several years were published in the 1930 chapter of this series. Data for 1931 were not available at the time this report was written.

SOURCE

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and miscellaneous secondary materials, such as scrap and waste, from various industrial processes.

The following table gives the quantity and source of the metal contained in the lead pigments and in the zinc pigments and salts produced in the United States in 1930 and 1931. It shows that in 1931, 96.3 per cent of the lead in lead pigments was derived from pig lead, 3.3 per cent from ore, and 0.4 per cent from secondary material. For zinc pigments and salts the proportions were 60.3 per cent from ore, 21.2 per cent from slab zinc, and 18.5 per cent from secondary material.

Metal content of lead pigments and zinc pigments and salts produced by domestic manufacturers, 1930 and 1931, by sources, in short tons

Source	1930		1931	
	Lead in pigments [1]	Zinc in pigments and salts	Lead in pigments [1]	Zinc in pigments and salts
Domestic ore	6, 686	104, 561	5, 722	74, 532
Metal	190, 182	27, 090	166, 328	26, 223
Secondary material [2]	689	22, 304	710	22, 799
	197, 557	153, 955	172, 760	123, 554

[1] Includes also lead recovered in zinc oxide and leaded zinc oxide. The metal content of lead acetate and lead arsenate is not available, as no canvass of their production is made by the Bureau of Mines. Moreover, these salts are derived from pig lead, and their metal content has already been taken into statistical account in the figures covering lead production.

[2] Zinc ashes, skimmings, drosses, and old metal.

In the following tables the source of the metal used in the manufacture of each pigment and salt is given. Pig lead is used exclusively, either directly or indirectly, in the manufacture of white lead, litharge, red lead, and orange mineral and, to a large extent, in the manufacture of basic lead sulphate. Zinc oxide is the only pigment in which slab zinc is used in considerable quantity. Ore is used in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulphate, and basic lead sulphate. Some secondary lead is used in the manufacture of basic lead sulphate, and a substantial proportion of the zinc in lithopone and zinc chloride made in the United States is derived from secondary material.

Lead content of lead and zinc pigments produced by domestic manufacturers, 1930 and 1931, by sources, in short tons

Pigment	1930				1931			
	Lead in pigments produced from—			Total lead in pigments	Lead in pigments produced from—			Total lead in pigments
	Domestic ore	Pig lead	Secondary material		Domestic ore	Pig lead	Secondary material	
White lead		87,329		87,329		78,374		78,374
Red lead		30,493		30,493		23,005		23,005
Litharge		67,510		67,510		60,446		60,446
Orange mineral		222		222		256		256
Basic lead sulphate	1,953	4,628	636	7,217	1,901	4,247	569	6,717
Leaded zinc oxide	4,693		53	4,746	3,821		141	3,962
Zinc oxide	40			40				
	6,686	190,182	689	197,557	5,722	166,328	710	172,760

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1930 and 1931, by sources, in short tons

Pigment or salt	1930				1931			
	Zinc in pigments and salts produced from—			Total zinc in pigments and salts	Zinc in pigments and salts produced from—			Total zinc in pigments and salts
	Domestic ore	Slab zinc	Secondary material		Domestic ore	Slab zinc	Secondary material	
Zinc oxide	71,324	27,085	149	98,558	47,460	26,136	45	73,641
Leaded zinc oxide	11,428		160	11,588	8,997		546	9,543
Lithopone	[1] 20,546		14,679	[1] 35,225	[1] 17,487		15,111	[1] 32,598
Zinc chloride		5	6,532	6,537		67	6,351	6,418
Zinc sulphate	1,263		784	2,047	588	20	746	1,354
	104,561	27,090	22,304	153,955	74,532	26,223	22,799	123,554

[1] Includes zinc content of a small quantity of zinc sulphide produced.

PREPARATION AND USES

A general discussion of the properties, uses, and preparation of lead and zinc pigments and zinc salts may be found in previous issues of this report. The following discussion summarizes the more recent developments and brings the statistical data up to date.

WHITE LEAD

A new process[3] for the preparation of white lead from litharge has been developed in Germany. Litharge is ground to a paste in the presence of carbon dioxide. Ammonia is added, resulting in the formation of ammonium carbonate and bicarbonate which in turn react with the litharge to produce basic lead carbonate. The white lead is said to be free from the normal carbonate. The ammonia is regenerated for reuse.

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[3] Oil, Paint and Drug Reporter, vol. 120, No. 23, Nov. 23, 1931, p. 16.

A mixture of white lead, oil, and graphite has been used successfully as a lubricant of open gears, and a mixture of white lead and mutton tallow is used to lubricate and protect control wires of airplanes.[4]

The United States usually exports about 6,000 tons of white lead annually, most of which is manufactured in bond from foreign lead.

The following table shows the sales of white lead (dry and in oil) to various industries in 1930 and 1931, as reported to the Bureau of Mines by the producers:

Distribution of white lead (dry and in oil) sales, 1930 and 1931, by industries

Industry	1930		1931	
	Short tons	Per cent of total	Short tons	Per cent of total
Paint	91,563	89.6	91,832	94.3
Ceramics	3,366	3.3	2,848	2.9
Other	7,211	7.1	2,688	2.8
	102,140	100.0	97,368	100.0

BASIC LEAD SULPHATE

The following table shows the sales of basic lead sulphate to various industries in 1930 and 1931, as reported to the Bureau of Mines by the producers:

Distribution of basic lead sulphate sales, 1930 and 1931, by industries

Industry	1930		1931	
	Short tons	Per cent of total	Short tons	Per cent of total
Paints	9,573	83.0	8,311	85.8
Storage batteries	1,104	9.6	697	7.2
Rubber	394	3.4	173	1.8
Other	456	4.0	505	5.2
	11,527	100.0	9,686	100.0

LITHARGE

Dr. John A. Schaeffer, director of research of the Eagle-Picher Lead Co., recently has called attention to the rapid advance made in storage-battery pigment technology during the past decade. After pointing out the improved performance of a battery in 1932 as compared with one in 1922 and the economy that has been effected in the use of lead oxides, he states:[5]

> The question you will rightly ask * * * is a proper one: "Just how has this tremendous increase in capacity been obtained with a lowering of the weight of active material used in the plate?" Such a question brings us to the develop-

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[4] Lead, vol. 2, No. 2, March, 1932, p. 3.

[5] Schaeffer, J. A., The Newer Developments in Lead Pigments and Their Uses: A paper presented before the Chicago chapter of the A. I. M. M. E., Mar. 16, 1932 (privately distributed), pp. 3–4.

> ments which have been made in the manufacture of storage-battery oxides. In 1922 it was the usual practice to produce oxides of lead for the storage-battery industry through the direct oxidation of metallic lead with subsequent milling over impact pulverizers. The result of this plan of manufacture was the production of a storage-battery oxide containing varying degrees of fineness with a predominance of rather large particles. It is a well-known fact that a storage-battery oxide, either litharge or red lead, must have such particle characteristics that a good bond can be obtained in the plate with, at the same time, great porosity; in other words, the maximum surface of the pigment particles should be exposed to the electrolyte with maximum physical strength. Whenever comparatively large particles of oxide are present, the porosity is not only cut down but at the same time the total reactive surface of the entire mass is greatly reduced. This statement holds true for both red lead and litharge, even though red lead is only used in the positive plate and there only in a rather small percentage.
>
> The efforts of the oxide manufacturer have been directed during the last 10 years toward producing an oxide of extreme fineness, yet one of such particle characteristics that proper bonding will be obtained with maximum porosity. Our studies have led us to different methods of furnacing coupled with greatly improved methods of milling. * * *
>
> Summing up these developments, we find that in the storage-battery industry the lead oxides have been improved through their method of manufacture to such an extent that we have been able to increase the capacity of a storage battery at 80° F. 40 per cent, with a corresponding decrease in the thickness of the plate of 27 per cent and a corresponding decrease in the weight of oxide per plate of 30 per cent, with no decrease in life.
>
> If any of us who were devoting our attention to the manufacture of lead oxides for use in the storage-battery industry 10 years ago had been told that we would to-day be producing materials for use in a battery which would result in producing such increases in capacity with the corresponding decrease in thickness of grid and reduction in quantity of active material, we would not have believed it possible. Now, just what has this meant to the consuming public? It has meant that the cost of a storage battery has been tremendously reduced. To-day any of you can go on the market and buy a battery for a standard light car at from $6 to $8 which will perfectly service your automobile for a satisfactory length of time. At the same time it has also meant the pronounced improvement we find in trying to start our automobile on a cold morning.

Doctor Schaeffer [6] also stated that the introduction of finely divided sublimed litharge into the petroleum refining process has resulted in a more rapid and complete chemical reaction and reduced costs of operation.

The rapid increase in the use of neon lights and radio tubes during the past few years has created a larger demand for electrical tubing, a glass containing about 22 per cent of lead in the form of litharge.

The following table shows the sales of litharge to various industries in 1930 and 1931, as reported to the Bureau of Mines by the producers:

Distribution of litharge sales, 1930 and 1931, by industries

Industry	1930		1931		Industry	1930		1931	
	Short tons	Per cent of total	Short tons	Per cent of total		Short tons	Per cent of total	Short tons	Per cent of total
Storage batteries	33,173	45.7	31,605	49.5	Rubber	4,736	6.5	3,032	4.7
Insecticides	6,000	8.3	7,508	11.8	Varnish	698	1.0	641	1.0
Oil refining	12,028	16.6	7,351	11.5	Linoleum	388	.5	208	.3
Ceramics	4,089	5.6	4,124	6.5	Other	8,180	11.3	5,839	9.1
Chrome pigments	3,286	4.5	3,582	5.6					
						72,578	100.0	63,890	100.0

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[6] Schaeffer, J. A., work cited, p. 7.

RED LEAD

A summary of recent developments in the use of red lead and litharge in the storage-battery industry is given in the discussion under litharge on page 216.

The following table shows the sales of red lead to various industries in 1930 and 1931, as reported to the Bureau of Mines by the producers:

Distribution of red-lead sales, 1930 and 1931, by industries

Industry	1930		1931	
	Short tons	Per cent of total	Short tons	Per cent of total
Storage batteries	18,998	57.7	13,700	53.0
Paints	10,906	33.1	9,256	35.8
Ceramics	835	2.5	811	3.1
Other	2,202	6.7	2,086	8.1
	32,941	100.0	25,853	100.0

ORANGE MINERAL

The following table shows the sales of orange mineral to various industries in 1930 and 1931, as reported to the Bureau of Mines by the producers:

Distribution of orange-mineral sales, 1930 and 1931, by industries

Industry	1930		1931	
	Short tons	Per cent of total	Short tons	Per cent of total
Ink manufacture	88	24.7	119	42.2
Color pigments	188	52.8	114	40.4
Other	80	22.5	49	17.4
	356	100.0	282	100.0

ZINC OXIDE AND LEADED ZINC OXIDE

The most recent source of data on the consumption of zinc oxide in the manufacture of rubber is the Census of Manufactures for 1929. According to this report 66,838 tons of zinc oxide were used in the manufacture of rubber goods in 1929; this was equivalent to 42 per cent of the total sales of zinc oxide reported by domestic producers in that year. Eighty-three per cent of the total was used in the manufacture of tires and inner tubes, 4 per cent in rubber boots and shoes, and 13 per cent in miscellaneous rubber goods. The data indicate that the average zinc oxide content of all rubber goods is about 6 per cent by weight.

According to the Census of Manufactures for 1929 the paint industry consumed 55,603 tons of zinc oxide in 1929. This quantity probably includes leaded zinc oxide also; thus the tonnage represents 30 per cent of the total sales of zinc oxide and leaded zinc oxide as reported to the Bureau of Mines for 1929.

Exports of zinc oxide in 1931 amounted to 5,131 short tons (5 per cent of the total production). Approximately 1,400 tons were imported.

LITHOPONE

A calcium-base lithopone has been developed recently in which calcium sulphate is substituted for barium sulphate. Owing to the lower specific gravity of calcium sulphate, the zinc sulphide content of the pigment can be increased and at the same time higher bulking values obtained. This type of pigment has very high hiding power and is especially adaptable where flat finishes are desired.

Lithopone producers reported the use of over 4,000 tons of lithopone in the manufacture of titanated lithopone in 1931.

Imports of lithopone into the United States in 1931 amounted to 5,674 short tons. Exports amounted to 3,821 tons, leaving a net import of 1,853 tons, the equivalent of 1.2 per cent of the domestic sales. Of the quantity imported 88 tons were classified as lithopone containing 30 per cent or more of zinc sulphide.

The following table shows the sales of lithopone to various industries in 1930 and 1931, as reported to the Bureau of Mines by producers:

Distribution of lithopone sales, 1930 and 1931, by industries

Industry	1930		1931	
	Short tons	Per cent of total	Short tons	Per cent of total
Paints, varnish, and lacquers	126, 076	76. 8	119, 446	78. 7
Floor coverings and textiles	23, 656	14. 4	20, 780	13. 7
Rubber	5, 997	3. 7	5, 833	3. 8
Other	8, 336	5. 1	5, 791	3. 8
	164, 065	100. 0	151, 850	100. 0

ZINC SULPHIDE

Zinc sulphide imparts to lithopone most of its useful pigment qualities, but only during the past decade has its usefulness as a separate pigment received general recognition. To-day it is recognized as one of the best white paint pigments; and its use in paints, enamels, and lacquers is increasing, particularly in the quick-drying paint products, where it is especially desirable because of its high hiding power. It is also used in the manufacture of dental rubber, linoleum, printing inks, and writing fluids. Production began in the United States in 1924 with an output of only 5,000 pounds. The output had increased to 126,000 pounds during the first 11 months of 1928.[7] Subsequent data on domestic production are not available for publication. Domestic quotations for zinc sulphide decreased from about 70 cents per pound in 1924 to 13 cents in 1931. Meanwhile, imports had increased from about 10,000 pounds in 1924 to 631,000 pounds in 1929, indicating a domestic consumption approximating 1,000,000 pounds. Since 1929 imports have declined sharply. Effective June 18, 1930, the import duty on zinc sulphide was increased from 1½ to 3 cents per pound.

A unique use of zinc sulphide in luminous paints has been developed in Germany.[8] Exceptionally pure zinc sulphide and cadmium sulphide possess marked phosphorescence, the period of luminosity varying with the color tones and composition of the pigment. The luminous paints are used in making signs, show cards, and various types of ornamentation. The dry pigment is used in printing, the powder being sprinkled over the text which is printed in gold size. An advantage of these luminous paints is that they contain no radium salts, phosphorus, or other poisonous substances.

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[7] Tariff Readjustment, 1929, Hearings Before the Committee on Ways and Means, House of Representatives: 70th Cong., 2d sess., vol. 1, Sch. 1, p. 822.
[8] Bureau of Foreign and Domestic Commerce, World Trade Notes: Vol. 6, No. 14, Apr. 4, 1932, p. 5.

ZINC SALTS

The quantity of zinc sulphate used as a depressing reagent in the flotation of complex lead and zinc ores amounted to 1,425 tons in 1929, 1,410 tons in 1928, and 1,010 tons in 1927.

Sales of zinc chloride increased during 1931, but the record shows that the production decreased, the excess sales having been made from stocks accumulated prior to 1931.

PRODUCERS AND PLANTS

The following companies reported having sold or used lead and zinc pigments and zinc salts of their own production in 1931:

White lead:	
Anaconda Lead Products Co. (electrolytic process)	East Chicago, Ind.
Carter White Lead Co	West Pullman, Chicago, Ill.
E. I. du Pont de Nemours & Co	Philadelphia, Pa.
Eagle-Picher Lead Co	East St. Louis, Ill.
Do	Cincinnati, Ohio.
Euston Lead Co	Scranton, Pa.
W. P. Fuller & Co	South San Francisco, Calif.
John T. Lewis & Bros. Co	Philadelphia, Pa.
National Lead Co	Chicago, Ill.
Do	St. Louis, Mo.
Do	Perth Amboy, N. J.
Do	Brooklyn, N. Y.
Do	Port Richmond, N. Y.
Do	Cincinnati, Ohio.
National Lead Co. of California	Melrose, Calif.
National Lead & Oil Co. of Pennsylvania	New Kensington, Pa.
Sherwin-Williams Co	Chicago, Ill.
Wetherill & Bro	Philadelphia, Pa.
Basic lead sulphate, or sublimed lead:	
Eagle-Picher Lead Co	Joplin, Mo.
Eagle-Picher Mining & Smelting Co	Galena, Kans.
St. Louis Smelting & Refining Works of National Lead Co	Collinsville, Ill.
Red lead, orange mineral, and litharge:	
Andrews Lead Co	Long Island City, N. Y.
Eagle-Picher Lead Co	East St. Louis, Ill.
Do	Joplin, Mo.
Do	Newark, N. J.
Do	Cincinnati, Ohio.
Evans Lead Co	Charleston, W. Va.
W. P. Fuller & Co	South San Francisco, Calif.
Morris P. Kirk & Son	Los Angeles, Calif.
John T. Lewis & Bros. Co	Philadelphia, Pa.
Metals Refining Co	Hammond, Ind.
National Lead Co	Chicago, Ill.
Do	St. Louis, Mo.
Do	Brooklyn, N. Y.
National Lead Co. of California	Melrose, Calif.
National Lead & Oil Co. of Pennsylvania	New Kensington, Pa.
Sherwin-Williams Co	Chicago, Ill.
Wetherill & Bro	Philadelphia, Pa.

Zinc oxide and leaded zinc oxide:	
American Zinc Co. of Illinois	Hillsboro, Ill.
American Zinc Oxide Co	Columbus, Ohio.
Eagle-Picher Lead Co	Hillsboro, Ill.
Empire Zinc Co	Canon City, Colo.
Grasselli Chemical Co	East Chicago, Ind.
International Lead Refining Co. (French process)	Do.
Do	Akron, Ohio.
Mineral Point Zinc Co	Mineral Point, Wis.
New Jersey Zinc Co. (of Pennsylvania)	Palmerton, Pa.
Do. (French process)	Freemansburg, Pa.
Ozark Smelting & Mining Co	Coffeyville, Kans.
St. Joseph Lead Co	Josephtown, Pa.
Lithopone:	
Chemical & Pigment Co. (Inc.)	Oakland, Calif.
Do	Collinsville, Ill.
Do	St. Helena, Md.
Eagle-Picher Lead Co	Argo, Ill.
Krebs Pigment & Color Corporation	Newport, Del.
Do	Newark, N. J.
Mineral Point Zinc Co	Depue, Ill.
New Jersey Zinc Co. (of Pennsylvania)	Palmerton, Pa.
Ozark Smelting & Mining Co	Coffeyville, Kans.
Sherwin-Williams Co	Chicago, Ill.
United Color & Pigment Co	Newark, N. J.
Zinc salts:	
American Smelting & Refining Co	Selby, Calif.
Do	Durango, Colo.
Do	Omaha, Nebr.
Do	Perth Amboy, N. J.
Charles Cooper & Co	Newark, N. J.
General Chemical Co	Chicago, Ill.
Grasselli Chemical Co	East Chicago, Ind.
Do	Cleveland, Ohio.
Do	Weirton, W. Va.
Great Western Electro-Chemical Co	Pittsburg, Calif.
Harshaw Chemical Co	Cleveland, Ohio.
Charles Lennig & Co. (Inc.)	Philadelphia, Pa.
Merrimac Chemical Co	Everett, Mass.
Ozark Smelting & Mining Co	Coffeyville, Kans.

The Ozark Smelting & Mining Co., a subsidiary of the Sherwin-Williams Co., began producing lithopone at its new plant at Coffeyville, Kans., during 1931.

The St. Joseph Lead Co. at Josephtown, Pa., began production of zinc oxide in January, 1931. The plant, which has a daily capacity of 120 tons of concentrate, was designed to treat zinc concentrates from the company's mines in St. Lawrence County, N. Y., by an electrothermic process. Sulphuric acid is manufactured from the by-product sulphur gases. The zinc oxide was sold chiefly to rubber manufacturers.

The Commercial Solvents Corporation, E. I. du Pont de Nemours & Co. (Inc.), and its affiliated company, the Grasselli Chemical Co., have formed a new company known as the Krebs Pigment & Color Corporation, to consolidate the lithopone and dry-color business of the Krebs Pigment & Chemical Co. and the pigment and dry-color division of Grasselli with the titanium pigment business of the Commercial Pigments Corporation, a subsidiary of Commercial Solvents. The new organization will combine the technical knowledge and research facilities of the companies interested.[9]

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[9] Industrial and Engineering Chemistry, News Edition, vol. 9, No. 17, Sept. 10, 1931, p. 284.

The new company has taken over the Newark (N. J.) plant of the Grasselli Chemical Co. and the Newport (Del.) plant of the Krebs Pigment & Chemical Co. The Grasselli Chemical Co. reported that pigment production has been permanently discontinued at its Grasselli (N. J.) and Philadelphia (Pa.) plants.

The Eagle-Picher Lead Co. discontinued the production of red lead and litharge at its Cincinnati plant in April, 1931, and white lead manufacture was suspended at the East St. Louis plant in June, 1931.

The New Jersey Zinc Co. was reported[10] as planning a $150,000 addition to its zinc sulphide plant at Palmerton, Pa.

TARIFF

No changes were made during 1931 in the import duties established by the tariff act of 1930, details of which were given in the 1930 chapter of this series.

IMPORTS AND EXPORTS

LEAD PIGMENTS

Imports of lead pigments into the United States are relatively unimportant. Exports of white lead pigments decreased 23 per cent in 1931 and amounted to 5 per cent of the total sales of domestic white lead; exports to the United Kingdom decreased 11 per cent and amounted to 85 per cent of the total. Combined exports of red lead, litharge, and orange mineral decreased 25 per cent in 1931 and amounted to over 3 per cent of the total sales by domestic manufacturers. The principal customers in 1931 and the percentage of the total taken by each follow: Canada 63 per cent, United Kingdom 8 per cent, Argentina and the Philippine Islands 3 per cent each, and Panama and Belgium 2 per cent each. Exports to Canada and Argentina increased 21 and 8 per cent, respectively, whereas those to the United Kingdom decreased 47 per cent. Netherland West Indies, which took 22 per cent of the total in 1930, took less than 1 per cent in 1931.

Basic carbonate white lead, red lead, litharge, and orange mineral imported for consumption in the United States, 1927–1931

Year	Basic carbonate white lead		Red lead		Litharge		Orange mineral	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1927	330,421	$29,901	51,688	$4,403	1,182	$133	44,866	$3,816
1928	166,236	15,889	24,675	1,510	2,100	153	62,409	5,227
1929	196,478	19,086	10,197	745	3,763	270	52,122	3,889
1930	147,132	13,496	19,116	1,334	968	90	25,338	1,955
1931	135,922	12,114	652	44	204	48	23,714	1,937

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[10] Chemical and Metallurgical Engineering, vol. 38, No. 7, July, 1931, p. 436.

White lead and red lead exported from the United States, 1927–1931

Year	White lead [1]		Red lead [2]	
	Short tons	Value	Short tons	Value
1927	6,047	$947,226	1,429	$271,376
1928	6,476	952,316	2,084	364,995
1929	5,908	921,509	2,890	503,243
1930	6,546	$923,281	4,128	$590,285
1931	5,008	562,228	3,087	384,929

[1] Export figures for 1927–1931 may include an unknown quantity of basic lead sulphate or sublimed lead.

[2] Exports of red lead and litharge not classified separately for 1927–1931; the figures may include an unknown quantity of litharge; the figures for 1928–1931 include also an unknown quantity of orange mineral.

White lead [1] exported from the United States, 1930 and 1931, by destinations

Destination	1930		1931	
	Short tons	Value	Short tons	Value
North America:				
Canada	66	$10,008	81	$11,191
Cuba	67	9,404	9	1,424
Mexico	98	21,041	39	7,499
Panama	101	16,809	1	153
Other	56	11,879	22	4,449
	388	69,141	152	24,716
South America:				
Argentina	434	67,890	67	8,800
Brazil	33	4,558	1	116
Colombia	3	702	2	471
Uruguay	43	6,727	1	165
Venezuela	11	2,406	6	1,028
Other	51	7,565	6	738
	575	89,848	83	11,318
Europe:				
Netherlands	257	$29,664	361	$35,128
United Kingdom	4,750	632,059	4,235	462,811
Other	68	9,208	23	3,176
	5,075	670,931	4,619	501,115
Asia:				
Philippine Islands	380	74,154	112	19,733
Other	104	14,713	11	1,833
	484	88,867	123	21,566
Africa	8	1,009	30	3,197
Oceania, including Australia	16	3,485	1	316
	6,546	923,281	5,008	562,228

[1] Exports of white lead and basic lead sulphate or sublimed lead not classified separately after 1922; the figures may include an unknown quantity of basic lead sulphate or sublimed lead.

ZINC PIGMENTS AND SALTS

Imports of lithopone, the principal zinc pigment imported into the United States, decreased 19 per cent in 1931 and were equivalent to 4 per cent of the domestic sales. Of the total quantity imported 88 tons were classified as lithopone containing 30 per cent or more of zinc sulphide. Imports of the zinc oxides increased 28 per cent and were equivalent to less than 2 per cent of the domestic sales. Imports of zinc sulphide, which increased rapidly from 1926 to 1929, declined 75 per cent in 1930 and 17 per cent in 1931. Nearly all the zinc pigments imported in 1931 came from Europe. The Netherlands supplied 91 per cent, Germany 7 per cent, and Belgium 2 per cent of the lithopone. All of the high-strength lithopone and 98 per cent of the zinc sulphide came from Germany. Imports of zinc oxide originated as follows: Belgium, 52 per cent; France, 22 per cent; United Kingdom, 12 per cent; Germany, 11 per cent; and other countries, 3 per cent.

Exports of zinc oxide, the principal zinc pigment exported from the United States, decreased 52 per cent in 1931, shipments to all of the principal consuming countries showing declines. Exports to Canada and the United Kingdom fell off 38 and 68 per cent, respectively; Canada took 55 per cent and the United Kingdom 30 per cent of the

1931 total. Exports of lithopone increased 4 per cent in 1931; Canada took 87 per cent of the total, the United Kingdom 6 per cent, and Cuba 3 per cent.

Zinc oxide, lithopone, zinc sulphide (white), zinc chloride, and zinc sulphate imported for consumption in the United States, 1927–1931

Year	Zinc oxide				Lithopone	
	Dry		In oil			
	Short tons	Value	Short tons	Value	Short tons	Value
1927	1,399	$220,427	77	$18,619	7,979	$656,166
1928	1,348	208,557	107	25,620	9,885	808,200
1929	1,267	203,080	110	27,145	8,409	725,554
1930	1,056	148,891	79	16,614	7,018	595,597
1931	1,352	170,169	105	19,308	5,674	428,523

Year	Zinc sulphide [1]		Zinc chloride		Zinc sulphate	
	Pounds [1]	Value	Short tons	Value	Short tons	Value
1927	132,223	$22,984	470	$40,069	205	$9,390
1928	338,030	47,235	563	47,185	683	28,866
1929	630,565	84,260	638	50,324	909	32,127
1930	159,533	23,552	351	28,811	519	17,819
1931	133,002	16,590	278	20,868	208	7,248

[1] Zinc sulphide is stated in pounds rather than tons because of its high value and smaller quantities.

Zinc oxide and lithopone exported from the United States, 1927–1931

Year	Zinc oxide		Lithopone	
	Short tons	Value	Short tons	Value
1927	14,494	$1,821,786	2,110	$222,585
1928	14,799	1,849,889	3,326	337,565
1929	17,638	2,301,643	4,556	463,235
1930	10,753	$1,446,904	3,665	$380,047
1931	5,131	717,224	3,821	341,257

Zinc oxide exported from the United States, 1930 and 1931, by destinations

Destination	1930		1931	
	Short tons	Value	Short tons	Value
North America:				
Canada	4,547	$628,178	2,818	$398,615
Cuba	91	13,960	58	9,489
Mexico	20	4,314	49	7,361
Panama	101	18,637	68	10,988
Other	53	8,016	5	841
	4,812	673,105	2,998	427,294
South America:				
Argentina	68	12,066	171	24,113
Brazil	9	1,928	4	1,178
Other	28	6,381	42	7,378
	105	20,375	217	32,669
Europe:				
France	428	$52,375	1	$308
Italy	115	16,651	55	8,538
United Kingdom	4,719	578,829	1,523	191,896
Other	116	18,024	134	16,580
	5,378	665,879	1,713	217,322
Asia:				
Philippine Islands	69	8,729	22	3,608
Other	107	20,244	71	14,482
	176	28,973	93	18,090
Africa	14	3,406	8	3,048
Oceania, including Australia	268	55,166	102	18,801
	10,753	1,446,904	5,131	717,224

PRICES AND VALUE

The total value and the average price received by producers from sales of lead and zinc pigments and salts are given on preceding pages of this chapter. The range of market quotations as reported by the Oil, Paint and Drug Reporter is shown in the following table:

Range of quotations on lead pigments and zinc pigments and salts at New York, 1929–1931, in cents per pound

Product	1929	1930	1931
Basic lead sulphate, or sublimed lead, dry, casks	7.75– 8.50	6.75– 7.75	6.00– 6.75
White lead, or basic lead carbonate:			
Dry, casks	8.25– 9.00	7.25– 8.25	6.50– 7.25
In oil, carload lots	10.73–11.54	10.69–11.54	9.33–10.30
Litharge, American, commercial, powdered, casks	8.75–10.25	7.75– 8.75	5.75– 7.75
Red lead, dry, casks	9.75–11.25	8.75– 9.75	6.75– 8.75
Orange mineral, American, casks	11.75–13.25	10.75–11.75	9.50–10.75
Lead acetate, brown, broken, barrels	12.00–13.50	10.50–13.00	10.00–10.50
Lead arsenate, powdered, drums	13.00–15.00	13.00–16.00	10.00–16.00
Zinc oxide:			
American process, lead-free, bags, car lots	6.50	6.50	6.50
American process, leaded, barrels, car lots	6.50	6.50	6.50
French process, red seal, bags, car lots	9.38	9.38	9.38
French process, green seal, bags, car lots	10.38	10.38	10.38
French process, white seal, barrels, car lots	11.63	11.63	11.63
Lithopone, American, bags, car lots	5.25	4.50– 5.25	4.50
Zinc chloride:			
Solution,[1] tanks	2.75– 3.25	2.25– 3.50	2.25– 3.00
Fused	5.25– 5.75	5.75	5.00– 5.75
Zinc sulphate, crystals, barrels	3.00– 3.75	3.00– 3.50	3.00– 3.50

[1] At works.

Quotations on dry white lead and basic lead sulphate were maintained at levels prevailing at the close of 1930 for the first 11 months of 1931; but in December, 1931, quotations dropped about three-fourths of a cent per pound. The price of white lead in oil was lower in January, 1931, than in December, 1930, but remained unchanged until December, 1931, when a reduction of 1 cent per pound was made. These declines represented decreases of about 10 per cent. Prices of the red oxides fluctuated with the pig-lead market. Quotations declined steadily during the first 5 months, then rose sharply during June to levels that were maintained until October, when a further decline began. The quotations for red lead and litharge declined 2 cents per pound net during the year, and orange mineral declined 1.25 cents per pound. Quotations on lead acetate and lead arsenate also declined in sympathy with the falling price of pig lead. The New York quotation for pig lead declined from 5.10 cents per pound on January 2 to 3.75 cents on December 31, or 26 per cent.

Quotations in 1931 on the various grades of zinc oxide were maintained at the level of the four preceding years, although the price of zinc (St. Louis) declined from 4.12½ cents at the beginning of 1931 to 3.12½ cents at the end. The quotation for ordinary lithopone was maintained at 4.5 cents per pound throughout 1931. Prices for zinc chloride and zinc sulphate responded to the drop in the zinc market. Quotations for zinc sulphide ranged from 16 to 32 cents per pound in 1930 and from 13 to 16½ cents in 1931.

GOLD, SILVER, AND LEAD IN SOUTH DAKOTA[1][2]

(MINE REPORT)

By C. W. Henderson

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SUMMARY

Metal mining in South Dakota began with the discovery of placer gold in 1875 in the gravels of French Creek near the present site of Custer. To date metal mining has been confined to the three southwestern counties—Custer, Lawrence, and Pennington—in what is known as the Black Hills. The Homestake gold mine at Lead, Lawrence County, has been producing almost continuously since 1876 and is now the largest producing gold mine in the United States. Ore from this mine to the company mills amounted to 1,403,939 tons in 1931, an increase of 39,483 tons over 1930, and the revenue from the sale of gold-silver bullion bars amounted to $8,935,307.15 in 1931—$509,111.94 more than in 1930. The realization per ton was $6.3645 in 1931 and $6.1755 in 1930. There were 5 other producing lode mines in South Dakota in 1931—1 in Lawrence County and 4 in Pennington County; their total output was small. At least 83 individual panning, rocking, and sluicing operations in South Dakota were productive in 1931; they yielded 96.17 fine ounces of placer gold valued at $1,988. The bulk of this gold was purchased by banks, merchants, and jewelers, who sold it to the Denver Mint; the remainder was sold in the crude state to tourists or shipped direct to the mint by producers. Of the placer operations, 41 were in Custer County, 22 in Lawrence County, and 20 in Pennington County.

The total recorded production of gold and silver (in terms of recovered metals) in South Dakota from 1875 to 1931, inclusive, has been $298,155,522 in gold and 7,883,626 fine ounces of silver.

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[1] Work on manuscript completed July, 1932.

[2] For information on the geology of the metal resources of South Dakota see Paige, Sidney, U. S. Geol. Survey Geol. Atlas, Central Black Hills Folio 219, 1925. Also, Connolly, J. P., and O'Harra, C. C., The Mineral Wealth of the Black Hills: South Dakota School of Mines Depts. of Geology and Mineralogy, Bull. 16, Rapid City, May, 1929.

The following table shows the number of producing mines, tons of ore produced, and recovered content of metals in South Dakota from 1927 to 1931.

Mine production of gold, silver, and lead in South Dakota, 1927–1931, in terms of recovered metals [1]

Year	Mines producing			Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)		Lead		Total value
	Lode	Placer	Total		Fine ounces	Value	Fine ounces	Value	Pounds	Value	
1927	2	2	4	1, 376, 583	322, 031. 74	$6, 656, 987	96, 171	$54, 529	138, 000	$8, 694	$6, 720, 210
1928	5	4	9	1, 422, 233	317, 378. 94	6, 560, 805	90, 547	52, 970	74, 000	4, 292	6, 618, 067
1929	2		2	1, 463, 159	316, 836. 85	6, 549, 599	85, 182	45, 402			6, 595, 001
1930	2	8	10	1, 365, 156	407, 221. 14	8, 418, 008	105, 236	40, 516			8, 458, 524
1931	6	83	89	1, 404, 153	432, 075. 39	8, 931, 791	113, 562	32, 933			8, 964, 724

[1] For total production of gold and silver in South Dakota, by years, see Henderson, C. W., Mineral Resources, 1913, Pt. 1, p. 42; Mineral Resources, 1922, Pt. I, p. 194; and subsequent volumes of same series.

Gold and silver produced at placer mines in South Dakota, 1927–1931 [1]

Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value	
1927	14. 46	$299			$299
1928	11. 13	230			230
1930	47. 41	980	5	$2	982
1931	96. 17	1, 988			1, 988

[1] No production in 1929.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*
1927	$0. 567	$0. 131	$0. 063	$0. 064
1928	. 585	. 144	. 058	. 061
1929	. 533	. 176	. 063	. 066
1930	$0. 385	$0. 130	$0. 050	$0. 048
1931	. 290	. 091	. 037	. 038

MINING AND METALLURGIC INDUSTRY

Production at the Homestake mine was continuous during 1931. A review of the Homestake and other operations is noted under the review by counties.

Gold and silver bullion produced at mills in South Dakota by amalgamation, 1927–1931

Year	Ore treated	Gold in bullion	Silver in bullion	Quicksilver used
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*
1927	1,371,583	208,952.00	52,480	14,188
1928	1,417,029	211,921.22	51,649	10,550
1929	1,437,935	210,869.03	51,676	9,225
1930	1,364,456	270,448.01	65,265	12,021
1931	1,404,106	288,155.99	67,857	15,305

Gold and silver bullion produced at mills in South Dakota by cyanidation, 1927–1931

Year	Material treated			Gold in bullion	Silver in bullion	Sodium cyanide used [1]
	Crude ore	Sands and slimes	Total			
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*
1927		1,353,298	1,353,298	113,058.32	41,005	312,626
1928	5,109	1,371,096	1,376,205	105,444.56	37,421	335,675
1929	25,224	1,358,870	1,384,094	105,967.82	33,506	353,859
1930	700	1,348,144	1,348,844	136,725.72	39,966	382,110
1931	47	1,400,191	1,400,238	143,823.23	45,705	[2] 375,535

[1] In terms of 96 to 98 per cent strength.

[2] Actually, 708,331 pounds of cyanamid (49 per cent strength) and 21,370 pounds of sodium cyanide (96 to 98 per cent strength); cyanamid reduced to equivalent of 96 to 98 per cent strength to conform with earlier use of figures for high-strength NaCN and KCN.

Mine production of metals from South Dakota crude ore shipped to smelters in 1928, in terms of recovered metals, was as follows: Crude ore, 95 short tons; gold, 2.03 fine ounces; silver, 1,477 fine ounces; and lead, 74,000 pounds. No crude ore was shipped to smelters in 1927 and in 1929 to 1931.

REVIEW BY COUNTIES

CUSTER COUNTY

Mine production of gold, silver, and lead in Custer County, S. Dak., 1927–1931, in terms of recovered metals [1]

Year	Mines producing		Ore	Gold (lode and placer)	Silver (lode and placer)	Lead	Total value
	Lode	Placer					
			Short tons		*Fine ounces*	*Pounds*	
1927	1		5,000	$144	2,686	138,000	$10,361
1928	1		95	42	1,477	74,000	5,198
1930		4		131			131
1931		41		942			942

[1] No production in 1929.

The lack of employment in 1931 caused individuals to try their hand at panning and rocking stream and bench gravel on Battle, French, and Spring Creeks. The small quantities of gold recovered were sold from time to time to banks in Custer County and, when enough had been accumulated, to the Denver Mint. The total gold produced during the year from Custer County was 45.57 fine ounces. The fineness of the gold ranged from 0.923 to 0.957 and that of the silver from 0.038 to 0.070. At one operation water was hauled 2½ miles and used in a rocker.

Desultory development work was done at the Spokane lode mine 17 miles northeast of Custer and 4½ miles southeast of Keystone, but no production was made.

LAWRENCE COUNTY

Mine production of gold and silver in Lawrence County, S. Dak., 1927–1931, in terms of recovered metals

Year	Mines producing			Ore	Gold (lode and placer)	Silver (lode and placer)	Total value
	Lode	Placer	Total				
				Short tons		*Fine ounces*	
1927	1	1	2	1,371,583	$6,656,738	93,485	$6,709,744
1928	1	4	5	1,416,949	6,533,894	88,829	6,585,859
1929	1	--------	1	1,437,935	6,491,184	84,987	6,536,482
1930	1	4	5	1,364,456	8,410,937	105,184	8,451,433
1931	2	22	24	1,403,964	8,928,512	113,507	8,961,429

HOMESTAKE MINE [3]

The total value of the product of the Homestake Mining Co. from 1876 to 1931, inclusive, is $243,482,630.55, and the amount paid in dividends is $59,990,986.29.[4]

Ore milled, receipts, and dividends, Homestake mine, 1927–1931

Year	Ore milled	Receipts for bullion product		Dividends
		Total	Per ton	
	Short tons			
1927	1,371,583	$6,679,802.31	$4.8701	$1,758,120
1928	1,416,949	6,566,784.69	4.6345	1,758,120
1929	1,437,935	6,517,837.95	4.5328	1,758,120
1930	1,364,456	8,426,195.21	6.1755	2,009,280
1931	1,403,939	8,935,307.15	6.3645	2,122,302

The annual report[5] of the general manager of the Homestake Mining Co. for the year ended December 31, 1931, says:

> At the end of the fifty-fourth year of its corporate life, the Homestake Mining Co. continues active production of gold from its mines. The ore blocked out insures continuous operation for 10 years at the present rate of milling.
>
> The year 1931 brought no unusual problems, and the mine and treatment plants have operated continuously.

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[3] For description of geology see Paige, Sidney, The Geology of the Homestake Mine: Econ. Geol., vol. 18, 1923, pp. 205–237; Geology of the Region Around Lead, S. Dak., and Its Bearing on the Homestake Ore Body: U. S. Geol. Survey Bull. 765, 1924, 56 pp.; Central Black Hills, S. Dak.: U. S. Geol. Survey Geol. Atlas, Folio 219, 1925. Hosted, J. O., and Wright, L. B., Geology of the Homestake Ore Bodies and the Lead Area, South Dakota: Eng. and Min. Jour.-Press, vol. 115, May 5, 1923, pp. 793–799; May 12, 1923, pp. 836–843.

[4] For total production by years of the Homestake mine, 1876–1915, by the Homestake Mining Co. and its predecessors see Henderson, C. W., Mineral Resources, 1915, Pt. I, p. 346. The totals through 1931 are the sum of the 1876–1915 totals and the figures for subsequent years.

[5] See also Engineering and Mining Journal, Gold Mining and Milling—The Homestake Enterprise: Vol. 132, No. 7, Oct. 12, 1931. See also Clark, A. J., Milling Methods and Costs at the Homestake Mine, Lead, S. Dak.: Inf. Circ. 6408, Bureau of Mines, 1931, 25 pp.

Following is a condensed report of the mine engineer:

Development drifts driven 16,858 feet; development raises driven 7,673 feet.

There are 672,630 tons of ore broken down and remaining in the stopes.

There are 15,116,178 tons of ore blocked out and remaining in the mine.

Additions to plants and equipment:

A new electrically operated hoist is now being installed at the Ellison shaft to replace the steam hoist.

A 5,000-kw. steam turbine has been installed in the present steam auxiliary plant at Lead. This unit will be ready to operate early in January, 1932.

Automatic sprinkler installations were completed in Cyanide No. 1 plant and the slime plant.

Statement of operations of the Homestake mine, Lead, S. Dak., for the year ended December 31, 1931

Operating revenue:		
Bullion—		
Proceeds of bars 7768–8090	$8, 935, 307. 15	
During the year 1,403,939 tons of ore were milled, realizing an average of $6.36446 per ton.		
Golden Gate timber operation	8, 187. 05	
Wyodak coal operation	36, 242. 89	
Interest and rents	225, 988. 61	
		$9, 205, 725. 70
Operating expenses:		
Mining, hoisting, and primary crushing	3, 119, 209. 30	
Tramming	33, 124. 89	
Milling	803, 566. 87	
Express on bullion	9, 995. 84	
Employees' welfare	148, 741. 85	
Taxes	639, 988. 53	
Insurance	22, 066. 48	
Salaries, office, legal, and general expenses	199, 390. 94	
Loss Ellison hoist fire	18, 423. 87	
Outside explorations; abandonments and investigation expenses	17, 236. 53	
		5, 011, 745. 10
Income		4, 193, 980. 60
Charges against income—reserved for depreciation and depletion		1, 757, 381. 25
Net income		2, 436, 599. 35
Dividends (all paid from earnings of year 1931)		2, 122, 302. 00

The Homestake mine is opened by three main shafts, the deepest of which is 2,900 feet, and by about 75 miles of adits, drifts, and crosscuts. In 1931, in addition to the drifts and raises driven, 11,224 feet of diamond drilling were done. The mining methods used at the Homestake were described by Ross and Wayland in 1926.[6]

A detailed description of the milling plants operated by the Homestake Mining Co. was published in the report of this series for 1930. No changes were made at these mills in 1931.

Both the mine and mill of the Bald Mountain Mining Co. (formerly the Trojan) were idle in 1931.

At the Sitting Bull-Richmond group, in the Bear Butte or Galena district 13 miles southeast of Pluma, reopened in 1930 after long idleness, 2,491 feet of drift and crosscuts were driven in 1931 to develop low-grade silver and lead ore. Construction work on a flotation mill was begun August 31 and completed January 1, 1932.

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[6] Ross, A. J. M., and Wayland, R. G., Mining Methods at the Homestake: Min. and Met., vol. 7, No. 229, January, 1926, p. 21. See also Wiggert, J. F., Electrification of a Large Gold Mine: General Elec. Rev., vol. 32, No. 9, September, 1929, pp. 477–489.

A trial shipment of less than a ton of ore was sent to the East Helena (Mont.) smelter. This shipment carried a high content of silver and low content of lead and gold; but the manager of the Double Rainbow Mines (Inc.), the operator of the group, has requested that the details of this trial shipment should not be published.

The resident placer miners on Bear, Beaver, Iron, and Potato Creeks near Tinton, Lawrence County, reported lack of water in 1931, but some of them managed to recover small quantities of placer gold.

In May, 1931, Waisanen Bros. leased their ground to the Bear Creek Association (J. J. Driskell, manager), which put in a power shovel and handled about 1,000 cubic yards of gravel during two months of operation in the fall of 1931, recovering about $200 in gold. The fineness of the Waisanen placer bullion was 0.911 in gold and 0.077 in silver.

Jewelers in Deadwood purchased small lots of gold recovered by panning and rocking operations conducted both by permanent resident placer miners and by new operators trying their hand at placer mining because of lack of employment. The purchases by the jewelers indicated that the small lots were recovered from Two Bit, Whitewood, and other creeks. The total placer gold credited to Lawrence County in 1931 was 28.35 fine ounces.

PENNINGTON COUNTY

Mine production of gold and silver in Pennington County, S. Dak., 1927–1931, in terms of recovered metals

Year	Mines producing		Ore	Gold (lode and placer)	Silver (lode and placer)	Total value
	Lode	Placer				
			Short tons		*Fine ounces*	
1927		1		$105		$105
1928	3		5, 189	26, 869	241	27, 010
1929	1		25, 224	58, 415	195	58, 519
1930	1		700	6, 940	52	6, 960
1931	4	20	189	2, 337	55	2, 353

Four lode mines in Pennington County produced in 1931. Small lots of gold ore were shipped from the Columbia-Bullion group and from the O.K.T. group at Keystone to the Golden Cycle mill at Colorado Springs, Colo. H. G. Mills, of Hill City, took out 5 tons from his Greenback mine and treated it in a small amalgamation mill, the resulting amalgam averaging 0.867 fine in gold and 0.036 fine in silver. From the Cochran property near Rochford amalgamation bullion averaging 0.596 fine in gold and 0.381 fine in silver was shipped to the Denver Mint.

Merchants and banks at Hill City shipped crude placer bullion containing a total of 22.25 fine ounces of gold to the Denver Mint in 1931. This gold was accumulated during the year in small purchases from panning and rocking operations of individuals, of whom some were regular residents of the county and others newcomers attempting to make a living.

GOLD, SILVER, AND COPPER IN WYOMING[1]

(MINE REPORT)

By C. W. Henderson

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SUMMARY

Wyoming lode and placer mines produced gold, silver, and copper valued in terms of recovered metals at $1,989 in 1931, compared with $10,713 in 1930. An 18-ton lot of copper ore was shipped to the Garfield (Utah) smelter from the Bonanza King mine in Carbon County, and a 5-ton lot of dry gold ore was shipped to a smelter from the McGrath or "1914"-Sullivan mine in Fremont County. Of the total production for the State $623 was gold from 7 placer mines—4 in Fremont County, 2 in Albany County, and 1 in Park County.

Mine production of gold, silver, and copper in Wyoming, 1927–1931, in terms of recovered metals

Year	Ore (short tons)	Gold	Silver		Copper		Total value
			Fine ounces	Value	Pounds	Value	
1927	110	$1,200	5	$3			$1,203
1928	129	677	53	31	2,604	$375	1,083
1929	143	995	26	14	4,301	757	1,766
1930	1,285	9,158	122	47	11,600	1,508	10,713
1931	23	1,165	17	5	9,000	819	1,989

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

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[1] Work on manuscript completed July, 1932.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064
1928	.585	.144	.058	.061
1929	.533	.176	.063	.066
1930	$0.385	$0.130	$0.050	$0.048
1931	.290	.091	.037	.038

REVIEW BY COUNTIES AND DISTRICTS

ALBANY COUNTY

Centennial district.[2]—In July the Cliff Gold Mining Co. shipped 2.2 tons of samples to the sampler of the Golden Cycle mill at Colorado Springs, Colo. The Commercial Gold Mining Co. reported assessment work done on its claims and as lessee of the Struggler and Marquette patented claims of the Utopia Mining & Milling Co. drove 300 feet of tunnel.

Douglas Creek district (*Holmes, Keystone*).—Two small lots of placer gold were shipped from the Douglas Creek district to the Denver Mint. Assessment work was continued on claims surrounding the Rambler group at Holmes, once a producer of gold-silver-copper-platinum-palladium ore.[3]

Tie Siding district.[4]—The 150-ton gravity concentration mill of the Copper-Gold Mines Corporation 1½ miles south of Tie Siding was idle in 1931. Underground development on this property consists of a 168-foot shaft and of 1,500 feet of drifts, of which 1,000 feet were driven in 1931.

CARBON COUNTY

Encampment or Upper Platte district.—From the Bonanza King mine two lots of copper ore (one lot of 8 tons carrying 9.47 per cent copper and one lot of 10 tons carrying 38 per cent copper) were shipped to the Garfield smelter in Utah. The property is 22 miles southeast of Encampment and is opened by 800 feet of adits and 200 feet of drifts. Assessment work was done at several other prospects in the district.

CONVERSE COUNTY

Assessment work only was done on the prospects south and southwest of Douglas. Development at the Miami group in sec. 10, T. 29 N., R. 75 W. of the sixth principal meridian 25 miles from Douglas consists of a 280-foot shaft and 500 feet of drifts. At the Douglas & Denver lode in sec. 26, T. 32 N., R. 73 W., development consists of a vertical shaft 25 feet deep, 75 feet of drifts, and 250 feet of adits.

CROOK COUNTY

The renewed interest in placer mining at Tinton, S. Dak., extended across the line into Crook County, Wyo., but no placer gold was extracted in 1931 from the area in Wyoming.

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[2] For map and description of properties see Hess, F. L., Platinum near Centennial, Wyo.; Contributions to Economic Geology: U. S. Geol. Survey Bull. 780, 1926, pp. 127–135.

[3] See Kemp, J. F., Platinum in the Rambler Mine, Wyoming: Mineral Resources, 1902, pp. 244–250. See Henderson, C. W., Mineral Resources, 1923, Pt. I, p. 591, and Mineral Resources, 1930, Pt. I, p. 688; also Mineral Resources, 1908–1929, Pt. I.

[4] For general geology and cross section see Darton, N. H., and Siebenthal, C. E., Geology and Mineral Resources of the Laramie Basin, Wyoming: U. S. Geol. Survey Bull. 364, Plates I and VIII, 1909.

FREMONT COUNTY

Atlantic City district.[5]—The Atlantic City district was the only producing district in Fremont County in 1931; lode and placer mines yielded, in terms of recovered metal, $826 in gold.

A clean-up of the mill on the McGrath or "1914"-Sullivan property resulted in the shipment of 5 tons of material containing 26.22 ounces of gold. Assessment work only was done on other lodes in the Atlantic City district. Panning, rocking, and sluicing operations in the district yielded 16.47 crude ounces of gold bullion, which after melting at the Denver Mint weighed 15.64 ounces and contained 13.74 fine ounces of gold and 1.88 fine ounces of silver.

Copper Mountain district.—In 1931 development work was continued at the Gold Nugget property on Copper Mountain; in 1930 a small quantity of gold-silver bullion was made at the 25-ton mill on the property. One of the difficulties at this property is lack of sufficient water. No work was done in 1931 at the Tieup in sec. 12, T. 40 N., R. 93 W., from which one car of copper ore was shipped in 1930.

GOSHEN COUNTY

Muskrat Creek district.—Assessment work only was done on copper prospects in the Muskrat Creek district.

LARAMIE COUNTY

Silver Crown district.—Assessment work was done at the Rambler-Silver Crown group (sec. 22, T. 14 N., R. 70 W.) and at the Monte Christo group (sec. 8, T. 14 N., R. 70 W.). The Rambler-Silver Crown group is opened by 30 feet of adit, a 65-foot vertical shaft, 70 feet of drifts, and a 40-foot winze. Lead, zinc, and copper minerals are found. The Monte Christo property is opened by a 50-foot vertical shaft and 12 feet of drifts. Sample assays indicate $4 to $16 in gold per ton of ore.

PARK COUNTY

Sluicing at the old Dietrick placer on Clark Fork south of the Montana-Wyoming boundary line resulted in an output in 1931 of 13.73 crude ounces of gold, with a fineness of 0.906 in gold and 0.077 in silver.

PLATTE COUNTY

Kuny Hills district (*Wheatland*).—No work was done at the Blue Jay group in sec. 20, T. 23 N., R. 69 W., from which a car of silver-copper ore was shipped in 1929.

Sunrise district.—The Colorado Fuel & Iron Co. Sunrise iron mine was idle part of the year; but when in operation shipped iron ore to the company's iron and steel plant at Pueblo, Colo. No copper ore was shipped from the property in 1931.

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[5] For geology see Spencer, A. C., The Atlantic Gold District and the North Laramie Mountains, Fremont, Converse, and Albany Counties, Wyoming: U. S. Geol. Survey Bull. 626, 1916, 85 pp.

SILVER, COPPER, LEAD, AND ZINC IN THE CENTRAL STATES[1]

(MINE REPORT)

By J. P. Dunlop and H. M. Meyer

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SUMMARY

The total value of the mine production of silver, copper, lead, and zinc in the Central States was $34,113,936 in 1931 ($34,199,300 less than in 1930). The total value from 1907 to 1931 was $2,427,655,531—$948,799,416 for zinc, $767,895,080 for copper, $703,548,790 for lead, and $7,412,245 for silver.

The value of metal production herein reported has been calculated at the figures given in the table that follows. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064	1930	$0.385	$0.130	$0.050	$0.048
1928	.585	.144	.058	.061	1931	.290	.091	.037	.038
1929	.533	.176	.063	.066					

Mine production of silver, copper, lead, and zinc in the Central States in 1931, by States

State	Silver		Copper		Lead		Zinc		Total value
	Fine ounces	Value	Pounds	Value	Short tons	Value	Short tons	Value	
Arkansas					78	$5,772			$5,772
Illinois	1,300	$377			205	15,170			15,547
Kansas					7,082	524,068	39,051	$2,967,876	3,491,944
Michigan	1,437	417	118,059,491	$10,743,414					10,743,831
Missouri	40,000	11,600			160,121	11,848,954	3,205	243,580	12,104,134
Oklahoma					13,210	977,540	78,132	5,938,032	6,915,572
Wisconsin					952	70,448	10,088	766,688	837,136
	42,737	12,394	118,059,491	10,743,414	181,648	13,441,952	130,476	9,916,176	34,113,936
Total, 1930	179,827	69,234	169,558,013	22,042,542	237,533	23,753,300	233,835	22,448,160	68,313.236

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[1] Work on manuscript completed July, 1932.

Silver.—Nearly all of the silver that has been produced in the Central States has been recovered incidentally in the production of other metals. No silver ore was mined in this area in 1931. The output of silver was as follows: 1,437 ounces of native lump silver from Michigan, 40,000 ounces from lead ore in southeastern Missouri, and 1,300 ounces from lead concentrates in Illinois.

Copper.—The mine production of copper in the Central States in 1931—118,059,491 pounds—was all from copper mines in Michigan. The mines decreased their output of copper ore 3,088,288 tons and their output of copper 51,321,922 pounds.

Lead.—The mine shipments of lead in the Central States in 1931 decreased 24 per cent in quantity and 43 per cent in value. Missouri produced 88 per cent of the total, and the recovered lead content of the galena and lead carbonate concentrates shipped from mines in Missouri was equivalent to 41 per cent of the refined primary lead recovered in the United States from domestic ores during the year. Of the total output of lead in Missouri the disseminated-lead district of southeastern Missouri produced 158,950 tons, or more than any other State or district in the United States. Southwestern Missouri produced 1,171 tons (161 tons more than in 1930). The production of lead in Oklahoma, as measured by the recovered metal in concentrates shipped, decreased from 23,052 tons in 1930 to 13,210 tons in 1931. The shipments from Kansas mines decreased from 12,910 tons in 1930 to 7,082 tons in 1931, those from Wisconsin mines from 1,537 to 952 tons, and those from Illinois mines from 248 to 205 tons. No lead ore was shipped from Kentucky in 1931, although some galena concentrates were recovered at fluorspar mines and held in stock. The production of lead in Kentucky in 1930 was 101 tons.

Zinc.—The mine production of zinc in the Central States in 1931 was equivalent to 45 per cent (48 per cent in 1930) of the total smelter output of primary slab zinc from domestic ores in the United States. Oklahoma produced 78,132 tons in 1931, compared with 136,153 tons in 1930. For many years prior to 1918 Missouri produced more zinc than any other State; in 1931, however, the output from Missouri mines was only 3,205 tons, whereas in 1917 it was 132,918 tons. The output of zinc in Kansas was 39,051 tons in 1931—87,256 tons less than in 1926, the year of largest output. In Wisconsin most of the mines were idle, and the output of zinc decreased from 12,558 tons in 1930 to 10,088 tons in 1931. Arkansas, Illinois, and Kentucky did not ship any zinc concentrates in 1931, and Iowa has not reported any shipments for many years.

TENOR OF ORES OF THE CENTRAL STATES

Quantity and tenor of copper, lead, and zinc ores, old tailings, etc., produced in the Central States, 1929–1931, by States

State	1929		1930		1931	
	Ore	Metal content[1]	Ore	Metal content[1]	Ore	Metal content[1]
	Short tons	*Per cent*	*Short tons*	*Per cent*	*Short tons*	*Per cent*
Kansas	5,321,100	2.98	3,517,300	2.86	1,913,200	3.04
Michigan	7,598,180	1.23	6,659,036	1.27	3,570,748	1.65
Missouri	6,868,000	3.13	7,010,100	3.08	5,240,400	3.17
Oklahoma	9,324,600	2.84	7,213,600	2.61	3,828,900	3.06
Wisconsin	607,100	3.79	486,400	3.66	318,700	3.99
	29,718,980	----------	24,886,436	----------	14,871,948	----------

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[1] The percentages given in this column represent the metal content of the ore in so far as it is recovered in the concentrates. In Michigan the metal so recovered is copper; in the other Central States the metals are lead and zinc, the relative proportions of which are shown in the table on page 237 and in the tables of tenor of ore given in the sections devoted to the respective States.

The radical decrease in quantity of ore treated in 1931 in the Central States was shared by the copper properties in Michigan and the lead and zinc properties in all producing States. No zinc or lead-zinc ore was mined in Arkansas, Illinois, Kentucky, or Iowa. The decrease in the quantity of such ores in Wisconsin was about 34 per cent, but the tenor of the ores increased appreciably. No lead ore was mined in Illinois or Kentucky and very little in Arkansas.

The average tenor of ore treated in the Central States in 1931 is indicated best by the average value of the total metal content recovered, which was $2.29 per ton of ore and old tailings treated. This value was 45 cents less than in 1930, due to the lower average prices of copper, lead, and zinc. The 11,301,200 tons of zinc, lead, and lead-zinc ores, old tailings, etc., exclusive of the small output from Arkansas and Illinois, treated in the Central States in 1931 yielded lead and zinc concentrates that sold for $16,786,289; consequently, the mine operators realized an average of $1.49 a ton of ore, old tailings, etc., mined, treated, and sold, compared with $1.84 in 1930. Briefly, they realized 19 per cent less for their product in 1931 than in 1930. The value of lead and zinc concentrates was much lower in 1931 than in 1930, and a greater proportion of old tailings to crude ore was treated.

Eight mills in Missouri reported flotation units; 86,637 tons of galena concentrates and 2,048 tons of sphalerite concentrates were recovered at these mills in 1931 by the flotation process. Nineteen mills in Kansas produced 820 tons of galena concentrates and 22,100 tons of sphalerite concentrates by flotation, and 30 mills in Oklahoma recovered 1,400 tons of galena concentrates and 42,800 tons of sphalerite concentrates by flotation. Only one all-flotation plant was operated in Wisconsin in 1931. Crude ore and old tailings treated at Oklahoma mills in 1931 decreased 47 per cent and at Kansas mills 46 per cent; lead ore from mines in southeastern Missouri decreased 25 per cent.

PRODUCTION OF LEAD AND ZINC BY REGIONS

The report of this series for 1930 gives the areas included in the seven lead and zinc producing regions of the Central States.

The southeastern Missouri region produced 87.5 per cent of the lead output of the Central States and 41 per cent of the primary lead recovered from domestic ore smelted or refined in the United States.

The Joplin region yielded 12 per cent of the lead and 91 per cent of the zinc output of the Central States in 1931 and was the largest producer of zinc in the United States with 41 per cent of the total slab zinc produced from domestic ores in 1931 and 44.3 per cent in 1930.

The lower zinc content of the zinc concentrates produced at mines in the upper Mississippi Valley region is indicated by the fact that although these mines yielded 13 per cent of the total output of raw zinc concentrates of all classes in 1931 the zinc content of such concentrates was only 8 per cent of the total output of zinc from mines in the Central States.

The lead content of the galena concentrates shipped from the upper Mississippi Valley region in 1931 averaged about 74.3 per cent, that of the concentrates from the Joplin region about 79 per cent, and that of the concentrates from the southeastern Missouri region 72.4 per cent. A very small proportion of the galena shipped from the Joplin region contained more than 82 per cent lead. Part of the sphalerite shipped from the Joplin region contained 58 to 60 per cent zinc, but large quantities averaged 60.5 to 62 per cent.

Mineral Resources for 1914 contains brief reviews of the history of lead and zinc mining in the Central States, the yearly production of each State from 1907 to 1914, inclusive, and historical notes and estimates of the total production of lead and zinc in each State before 1907.

Mine production of lead and zinc in the Central States in 1931, by regions

Region	Lead [1]		Zinc [2]		Total value
	Short tons	Value	Short tons	Value	
Concentrates:					
Joplin	27,982	$1,256,608	225,779	$5,277,087	$6,533,695
Southeastern Missouri	223,853	9,833,045	2,408	43,000	9,876,045
Upper Mississippi Valley [3]	1,307	59,277	34,200	317,272	376,549
Kentucky-southern Illinois	346	13,787			13,787
Northern Arkansas	100	4,000			4,000
	253,588	11,166,717	262,387	5,637,359	16,804,076
Total, 1930	329,244	19,926,098	479,350	13,644,315	33,570,413
Metal:					
Joplin	21,463	1,588,262	119,168	9,056,768	10,645,030
Southeastern Missouri	158,950	11,762,300	1,220	92,720	11,855,020
Upper Mississippi Valley [3]	952	70,448	10,088	766,688	837,136
Kentucky-southern Illinois	205	15,170			15,170
Northern Arkansas	78	5,772			5,772
	181,648	13,441,952	130,476	9,916,176	23,358,128
Total, 1930	237,533	23,753,300	233,835	22,448,160	46,201,460

[1] Includes both galena and a small quantity of lead carbonate concentrates.
[2] Includes sphalerite and a small quantity of zinc carbonate and zinc silicate concentrates.
[3] Includes Iowa, northern Illinois, and Wisconsin.

REVIEW BY STATES AND DISTRICTS

ARKANSAS

By J. P. Dunlop

The value of the lead and zinc from Arkansas mines was only $5,772 in 1931, compared with $1,430,668 in 1917.

The production of galena in Arkansas is small. No zinc concentrates were shipped in 1930 or 1931. Notes on the lead and zinc mines of Arkansas are given in the report of this series for 1930.

Mine production of lead and zinc in Arkansas, 1927–1931

Year	Lead concentrates (galena)		Zinc concentrates (silicate and carbonate)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	30	$2,590	386	$9,453	23	$2,898	128	$16,384
1928	50	4,010	224	5,600	38	4,408	86	10,492
1929	66	5,500	25	605	51	6,426	9	1,188
1930	68	4,033			53	5,300		
1931	100	4,000			78	5,772		

[1] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in Arkansas, 1928–1931

	1928	1929	1930	1931
Total ore……short tons	(1)	(1)	(1)	(1)
Average lead content of galena concentrates……per cent	76	78.8	80.0	80.0
Average zinc content of zinc silicate and carbonate……do	43	40.2	----------	----------
Average value per ton:				
Galena concentrates	$80.20	$83.33	$59.31	$40.00
Zinc silicate and carbonate	25.00	24.20	----------	----------

[1] The quantity of ore mined was very small, and very little of it was milled, so that no calculations as to tenor are available; part of the ore sold was taken from stock in bins.

In 1931 only one lead mine was operated in Arkansas, and no development of importance took place. All the galena concentrates shipped in 1931 were from the Brewer land near Ponca, Newton County. The Morning Star mine and mill and other properties near Rush were idle.

ILLINOIS

By J. P. Dunlop

Mine production of lead and zinc in Illinois, 1927–1931 [1]

District	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	420	$29,772	2,726	$30,722	277	$34,902	521	$66,688
1928	600	44,315	69	824	385	44,660	17	2,074
1929	668	51,072	112	1,962	443	55,818	31	4,092
1930	379	19,520	30	388	248	24,800	9	864
1931	346	13,787	--------	----------	205	15,170	--------	----------

[1] Mineral Resources for 1914 contains a historical review of lead and zinc mining in Illinois.

[2] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in Illinois, 1928–1931

	1928	1929	1930	1931
NORTHERN ILLINOIS				
Total ore……short tons	(1)	(2)	(2)	----------
Average lead content of galena concentrates……per cent	78.0	----------	----------	----------
Average zinc content of sphalerite concentrates……do	27.5	36.0	38.7	----------
Average value per ton:				
Galena concentrates	$76.46	----------	----------	----------
Sphalerite concentrates	11.94	$17.52	$12.93	----------
SOUTHERN ILLINOIS				
Average lead content of galena concentrates……per cent	65.4	67.7	66.8	60.4
Average value per ton of galena concentrates	$73.81	$76.46	$51.50	$39.85

[1] Concentrates shipped were milled in 1927.

[2] Old tailings only treated.

Mine production of silver in southern Illinois, 1927–1931

Year	Silver		Lead concentrates, silver-bearing		Year	Silver		Lead concentrates, silver-bearing	
	Fine ounces	Value	Short tons	Ounces of silver per ton		Fine ounces	Value	Short tons	Ounces of silver per ton
1927	1,518	$861	310	4.90	1930	1,797	$692	379	4.74
1928	3,146	1,840	589	5.34	1931	1,300	377	346	3.76
1929	3,700	1,972	668	5.54					

The value of the mine production of silver and lead in Illinois in 1931 was $15,547 compared with silver, lead, and zinc valued at $26,356 in 1930.

The lead and zinc deposits of Illinois fall into two distinct regions marked by different mineral associations and structural environment. Those of southern Illinois belong to the Kentucky-Illinois fluorspar district; those of northern Illinois belong to the upper Mississippi Valley region.

NORTHERN ILLINOIS

No mill was operated in northern Illinois in 1931, no ore was mined, and little prospect drilling was done.

SOUTHERN ILLINOIS

The total production of galena concentrates in southern Illinois from 1906 to 1931 has been 18,134 tons, most of which has been shipped from the Fairview, Rosiclare, and Hillside mines. The shipments of zinc ores from the district have been comparatively small and scattered. The only recorded shipments of zinc carbonate, aggregating 103 tons, were made from the Empire mine in 1903 or 1904 and from four companies in 1906.

The quantity of galena concentrates shipped from southern Illinois decreased from 379 tons in 1930 to 346 tons in 1931. Most of the output was from the property of the Hillside Fluor Spar Mines near Rosiclare.[2] The ore from the Hillside mine is milled at a plant (capacity, 200 tons of crude ore per 9-hour day) equipped with a washing screen, a picking belt, tables, and jigs. The galena concentrates, assaying 66.5 per cent lead and about 5 ounces of silver a ton, were shipped to the St. Louis plant of the National Lead Co. The Rosiclare [3] mill shipped in 1931 silver-bearing galena concentrates having a lead content of 64.6 per cent. The fluorspar mines were operated on a much reduced scale in 1931 owing to the slack demand for their product; consequently, the output of galena concentrates was below normal. The Franklin Fluorspar Co. recovered some galena in 1931 but did not ship any concentrates to smelters.

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[2] Reeder, E. C., Milling Methods and Costs at the Hillside Fluorspar Mines, Rosiclare, Ill.: Inf. Circ. 6621, Bureau of Mines, 1932, 20 pp.

[3] Cronk, A. H., Mining Methods of the Rosiclare Lead & Fluorspar Mining Co., Rosiclare, Ill.: Inf. Circ. 6384, Bureau of Mines, 1930, 13 pp.

IOWA

The lead and zinc deposits of Iowa extend along the Mississippi River for nearly 80 miles in Dubuque, Clayton, and Allamakee Counties. No shipments of lead or zinc concentrates from mines in Iowa have been reported since 1917.

KANSAS

By J. P. Dunlop

Mine production of lead and zinc in Kansas in 1931, by districts

District	Lead concentrates[1]		Zinc concentrates		Metal content[2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Blue Mound-Baxter Springs	7,560	$329,164	70,577	$1,578,727	5,780	$427,720	37,437	$2,845,212
Crestline	1,099	54,589	1,049	23,739	889	65,786	542	41,192
Galena	624	20,478	1	13	413	30,562	1	76
Waco	--------	-----------	2,063	49,513	--------	-----------	1,071	81,396
	9,283	404,231	73,690	1,651,992	7,082	524,068	39,051	2,967,876
Total, 1930	16,935	1,143,819	143,348	4,480,572	12,910	1,291,000	74,304	7,133,184

[1] Includes 270 tons of lead carbonate, containing 57 per cent lead, from Galena in 1931 and 63 tons, containing 58.7 per cent lead, in 1930.

[2] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1930 and 1931

	1930		1931	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore and old tailings milled .... short tons	2,355,100	1,162,200	1,040,800	872,400
Total concentrates recovered:				
Galena .... do	19,758	165	8,882	401
Sphalerite .... do	128,367	14,981	55,537	18,153
Ratio of concentrates to ore, etc.:				
Lead .... per cent	0.84	0.01	0.94	0.05
Zinc .... do	5.45	1.29	6.30	2.09
Metal content of ore, etc.:				
Lead .... do	.65	.01	.73	.03
Zinc .... do	3.23	.73	3.80	1.24
Average lead content of galena concentrates .... do	77.9	55.1	79.3	61.1
Average zinc content of sphalerite concentrates .... do	59.2	56.5	60.4	59.8
Average value per ton:				
Galena concentrates	$67.87	$42.94	$44.99	$24.81
Sphalerite concentrates	31.80	25.90	23.26	19.86

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1928–1931

	1928	1929	1930	1931
Total ore and old tailings milled short tons	4,662,200	5,321,100	3,517,300	1,913,200
Total concentrates in ore, etc.:				
Lead per cent	0.69	0.63	0.57	0.54
Zinc do	4.33	4.18	4.10	4.37
Metal content of ore, etc.:				
Lead do	.55	.50	.44	.42
Zinc do	2.61	2.48	2.42	2.62
Average lead content of galena concentrates do	79.6	79.0	77.7	78.5
Average zinc content of sphalerite concentrates do	59.0	59.3	58.9	60.2
Average value per ton:				
Galena concentrates	$80.90	$86.08	$67.63	$44.09
Sphalerite concentrates	37.60	40.70	31.26	22.40

The following publications of the Bureau of Mines relate to mining and milling methods at the lead and zinc properties in Cherokee County, Kans.

Netzeband, W. F. Method and cost of mining zinc and lead at No. 3 mine, tri-State district, Crestline, Kans. Inf. Circ. 6174, Bureau of Mines, 1929, 10 pp.

Banks, L. M. Mining methods and costs in the Waco district. Inf. Circ. 6150, Bureau of Mines, 1929, 10 pp.

Keener, O. W. Method and cost of mining at Barr mine, tri-State zinc and lead district. Inf. Circ. 6159, Bureau of Mines, 1929, 9 pp.

——— Methods and costs of mining at the Hartley-Grantham mine, tri-State zinc and lead district. Inf. Circ. 6286, Bureau of Mines, 1930, 8 pp.

Although the Eagle-Picher Mining & Smelting Co. drained a substantial part of the mining area in the Galena camp to a depth of 100 feet the output continued small. Most of the production of lead and zinc from Kansas continued to come from the Blue Mound-Baxter Springs part of the Miami field. The output of both the Waco and Crestline camps showed a large decrease in 1931. Total shipments of zinc concentrates from mines in the State decreased 69,658 tons; total shipments of lead concentrates decreased 7,652 tons. Very few drills were operated in Kansas in 1931, and no new mining areas were developed.

Blue Mound-Baxter Springs district.—The shipments of concentrates from the Blue Mound-Baxter Springs area amounted to 7,560 tons of galena and 70,577 tons of sphalerite in 1931, compared with 14,866 tons of galena and 131,290 tons of sphalerite in 1930. The average lead content of the galena sold in 1931 was 78 per cent, and the zinc content of the sphalerite was 60.2 per cent. The quantity of both crude ore and old tailings milled decreased in 1931, and a larger proportion of the total was old tailings than in 1930. The crude ore (old tailings excluded) milled in 1931 yielded 7.90 per cent in concentrates, compared with 6.96 per cent in 1930. About 79 per cent of the galena and 85 per cent of the sphalerite shipped from this area came from mines in the vicinity of Blue Mound, which shipped 5,998 tons of galena and 60,304 tons of sphalerite. The mines in the vicinity of Baxter Springs and east of Blue Mound in Kansas shipped 1,562 tons of galena and 10,273 tons of sphalerite. Several thousand tons of concentrates produced in 1931 were not shipped. Little development work was done, and few mills were built or moved. The old Barr mill of the Vinegar Hill Zinc Co. was torn down and a 500-ton plant erected; this plant was only operated about three months in 1931. Most of the large mills were closed part of the time; those at the Ballard, Paxton, Velie, and Hartley mines were idle all the year. The H. & B. Mining Co. leased the upper levels of the Hartley mine, and the Cimaron Mining Co. acquired Boska No. 2.

The producing properties near Baxter Springs in 1931 were the Barnsdall, Brugger, Cimaron, Crume, Hartley, Hartley-Grantham, Otis, Peru, and Peru-Laclede (tailings). The producing properties in the Blue-Mound area were the Barr, Bendelari, B H & E (tailings), Big John, Black Eagle, Cherokee, Chubb, Early Bird (tailings), Foley, Jay Hawk, Kansas Line, King Brand, Mid Continent, Robinson, Tri-State (tailings), Webber, West Side, and Wilbur.

The mines that shipped more than 400 tons each of galena in 1931 were the Barr, Bendelari, Big John, Black Eagle, Mid Continent, and Peru; other properties produced more than 400 tons of galena but did not ship all their output. The mines that shipped more than 3,000 tons each of sphalerite in 1931 were the Barr, Bendelari, Black Eagle, Cherokee, Early Bird, Jarrett (Kansas Exploration, Inc.), King Brand, Mid Continent, Peru, and Robinson.

Crestline district.—The production of the Crestline district was 1,099 tons of galena and 1,049 tons of sphalerite in 1931 compared with 1,841 tons of galena and 3,546 tons of sphalerite in 1930. Most of the mines were idle part of the year and all were idle in December. The Crutchfield mine was the only large producer; however, its output decreased substantially. The Glendale mine was operated for a few weeks. The two mills of the Crestline Products & Service Co. were not operated.

Galena district.—The production of lead concentrates in the Galena district was 354 tons of galena and 270 tons of lead carbonate in 1931 compared with 165 tons of galena and 63 tons of lead carbonate in 1930. All the lead concentrates were produced by small operators working on upper levels of old mines or culling from old dumps. The Eagle-Picher Mining & Smelting Co. drained much of the old mining area to a depth of about 100 feet so that scrappers could enter old drifts or new shafts could be sunk. The output of lead concentrates was marketed in small lots at the Galena smelter.

Waco district.—The total output of the Waco district was 4,014 tons of sphalerite in 1931 compared with 16,501 tons of sphalerite and 72 tons of galena in 1930. The district lies partly in Missouri and partly in Kansas; shipments from the Kansas side of the district amounted to 2,063 tons of sphalerite in 1931 compared with 8,497 tons in 1930. The entire output in both years was that of the Missouri-Kansas Zinc Corporation. The mines were operated by a receiver for the bondholders in 1931, and the plant was sold at auction late in the year. There is a large area of known ore on the lease, but it can not be mined profitably at the prevailing price of sphalerite.

KENTUCKY

By J. P. Dunlop

Mine production of lead and zinc in Kentucky, 1927–1931 [1]

Year	Lead concentrates (galena)		Zinc concentrates				Metal content			
			Sphalerite		Zinc carbonate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	241	$14,070	352	$5,392	2,136	$46,514	139	$17,514	860	$110,080
1928	59	4,959			265	6,032	39	4,524	92	11,224
1929	496	29,623					287	36,162		
1930	184	7,111					101	10,100		

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[1] No production reported for 1931.

No lead or zinc concentrates were shipped from mines in Kentucky in 1931. Some operators, such as the Eagle Fluor Spar Co., Lafayette Fluorspar Co., and Kentucky Fluor Spar Co., may have recovered some galena and stored it to await better prices.

MICHIGAN

By H. M. Meyer

The output of refined copper in Michigan was 118,059,491 pounds in 1931 compared with 169,381,413 pounds in 1930. The high average yield of copper during 1931—33.1 pounds to the ton (1.65 per cent) compared with 25.4 pounds (1.27 per cent) in 1930 and 24.5 pounds (1.23 per cent) in 1929—was due partly to the fact that Calumet & Hecla Consolidated Copper Co. treated no copper sands in 1931. Moreover, selective mining was done in the district in an effort to maintain or, if possible, raise the grade of rock mined to offset in some degree the decreased price of refined copper. Large stocks of copper and of mineral were on hand at all properties and, together with the greatly lessened demand for copper, made it advisable for companies in the district to curtail operations drastically. This was done by ceasing operations in parts of some mines and by reducing working time and number of workers employed. Total output for the year was 30 per cent lower than in 1930, but operations at the end of the year were on a considerably lower basis than the average decline indicates. By the end of the year all night shifts were eliminated at operating properties of Calumet & Hecla Consolidated Copper Co. and Isle Royale Copper Co.; day shifts were on a 5-day week basis at Calumet & Hecla and on a basis of 18 shifts a month at Isle Royale; working time at Copper Range was reduced to 4 days a week, and early in 1932 to 3 days a week; Mohawk was operating full time, 2 shifts a day on a 6-day week basis, owing to conditions at the mine explained later in this report; and Quincy Mining Co. was completely shut down. Other efforts were made at all mines and plants to bring the cost of producing copper below the average selling price. Costs at the end of the year were impressively lower, but the reductions made did not keep step with the rapidly falling price of the metal.

F. G. Pardee, mine appraiser of Michigan, did not issue a statement of copper costs in Michigan for 1931.

Mine production of silver and copper in Michigan, 1927–1931 [1]

Year	Silver (fine ounces)	Copper [2]			Concentrate ("mineral") [3]		Ore [4] ("rock") (short tons)
		Pounds	Yield		Pounds	Yield (per cent)	
			Pounds per ton of ore ("rock")	Per cent			
1927	97,193	177,537,775	22.1	1.10	275,460,828	64.5	8,046,334
1928	17,153	178,442,704	24.2	1.21	283,405,073	63.0	7,361,658
1929	20,795	186,402,218	24.5	1.23	286,583,602	65.0	7,598,180
1930	7,820	169,381,413	25.4	1.27	258,005,986	65.7	6,659,036
1931	1,437	[5] 118,059,491	[5] 33.1	[5] 1.65	[5] 172,431,815	[5] 68.5	[5] 3,570,748

[1] The figures are based on the actual recovery of copper from "mineral" smelted and the estimated recovery from "mineral" that was not smelted during the year.
[2] Includes copper from sands.
[3] Includes "mineral" from sands.
[4] Includes sands.
[5] No sands reported for 1931.

Value of silver and copper produced in Michigan mines, 1927–1931

Year	Silver	Copper		Total
		Total	Per ton of ore ("rock")	
1927	$55,109	$23,257,449	$2.89	$23,312,558
1928	10,035	25,695,749	3.49	25,705,784
1929	11,084	32,806,790	4.32	32,817,874
1930	$3,011	$22,019,584	$3.31	$22,022,595
1931	417	10,743,414	3.01	10,743,831

Practically the entire issue of the Mining Congress Journal for October, 1931, was devoted to discussions of the history, geology, mining methods, milling and smelting operations, safety policies, costs, etc., of the Calumet & Hecla Consolidated Copper Co. During 1931 the mines of the company produced 72,367,000 pounds of copper at an average cost sold (not including depreciation and depletion) of 9.77 cents a pound compared with 87,898,000 pounds in 1930 at an average cost sold of 10.56 cents a pound. The reclamation plants at Lake Linden and Hubbell were both idle. In 1930 these plants produced 17,842,000 pounds of copper at an average cost sold of 6.71 cents a pound.

In the conglomerate branch, mining of shaft pillars and old backs, which extend into higher zones of the mine where the rock is richer, raised the grade of rock from 48.69 pounds to the ton in 1930 to 51.48 pounds in 1931. Ore from the heavy shaft pillars and backs will continue to be a sweetener for about 15 years, according to an article in the Engineering and Mining Journal,[4] as the process of mining the large remaining tonnage from the bottom upward is slow. Deep mining methods at the conglomerate mine have been described by Vivian.[5] All operations at the Osceola amygdaloid branch, except that of pumping water, were discontinued on May 31. The copper content of rock from this branch stamped during the year was 18.31 pounds to the ton, compared with 17.86 pounds in 1930. At the Calumet mill 40,508 tons of Osceola amygdaloid rock and 783,829 tons of conglomerate rock were stamped; and at the Ahmeek mill 1,000,498 tons of amygdaloid rock from the Ahmeek, North Kearsarge, and Centennial branches of the Kearsarge lode and 240,828 tons of Osceola amygdaloid were treated. A second stamp unit at the Ahmeek mill was equipped for complete fine grinding and flotation of all jig tailings. The smelter treated 55,000 tons of concentrates and mass from Calumet & Hecla mines and 100 tons from the Isle Royale property; in all, 71,100,000 pounds of refined copper were produced. Plants of the Lake Milling, Smelting & Refining Co. were idle during the year. On December 31 all night-shift operations at branches that were not entirely shut down were discontinued, and working time was confined to 5 day shifts a week. No dividends were paid during the year.

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[4] Engineering and Mining Journal, vol. 132, No. 8, Oct. 26, 1931, p. 377.
[5] Vivian, Harry, Deep Mining Methods, Conglomerate Mine, Calumet & Hecla Consolidated Copper Co.: Inf. Circ. 6526, Bureau of Mines, 1931, 20 pp.

The Isle Royale Copper Co. treated 353,075 tons of rock during 1931, from which 7,731,418 pounds of refined copper (21.90 pounds to the ton) were obtained compared with 510,262 tons of rock treated in 1930, yielding 10,659,413 pounds of copper (20.89 pounds to the ton). The average cost of copper sold (not including depreciation and depletion) was 11.48 cents a pound in 1931, and the average price received for copper sold was 8.66 cents a pound. During the first 10 months of the year the Isle Royale mill was operated at 60 per cent of capacity and during November and December at 37 per cent. No dividends were paid by the Isle Royale Copper Co. in 1931.

Copper produced by the Isle Royale Copper Co., 1928–1931

	1928	1929	1930	1931
Rock hoisted short tons	560, 598	669, 049	668, 700	450, 682
Rock-house discard do	119, 867	154, 025	158, 438	97, 607
Rock treated do	440, 731	515, 024	510, 262	353, 075
Cost of mining, transportation, stamping, and taxes per ton of rock	$2. 71	$2. 67	$2. 44	$2. 24
Refined copper produced pounds	10, 520, 771	10, 864, 085	10, 659, 413	7, 731, 418
Refined copper per ton of rock treated do	23. 87	21. 09	20. 89	21. 90

The Copper Range Co. acquired the assets of St. Mary's Mineral Land Co. on December 23, and the ownership of the Champion mine is no longer divided. A total of 17,721,270 pounds of copper was produced by the company in 1931 at an average cost delivered, exclusive of depreciation and depletion, of 9.754 cents a pound; the average price received for copper sold during the year was 8.2 cents a pound. Operations at the Baltic mine were about the same as in 1930, whereas production at the Champion property was largely curtailed. Working time was reduced from five to four days a week in June. The Baltic mine was closed on December 31, and production from No. 1 shaft of the Champion mine was discontinued shortly thereafter. Working time was reduced to three days a week in March, 1932. The second Dorr thickening and filtering plant at the Champion stamp mill was completed and placed in operation during 1931. Remodeling of the No. 2 unit for flotation progressed, but classifiers and flotation equipment were not purchased and all construction was stopped pending improvement in the copper industry. Flotation practice at the Champion mill is described by Koepel.[6] The entire property of the Naumkeag Copper Co., aggregating 10,072 acres of mineral lands and 420 acres of surface, just east of the Atlantic mine (already owned by the company), was also purchased during 1931. No dividends were paid during the year.

Copper produced by the Champion mine of the Copper Range Co., 1927–1931

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received	Net profit
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1927	403, 260	16, 098, 926	39. 92	10. 84	13. 42	$455, 791. 07
1928	427, 240	19, 563, 535	45. 79	11. 10	15. 01	829, 357. 45
1929	446, 804	20, 660, 701	46. 24	11. 76	17. 94	1, 267, 685. 97
1930	(2)	19, 999, 564	44. 57	11. 60	11. 43	[3] 32, 955. 04
1931	[4] 404, 830	[4] 17,721, 270	[4] 43. 77	[4] 9. 754	[4] 8. 2	[3] [4]451, 450. 25

[1] Excludes depreciation and depletion.
[2] Figures not given.
[3] Deficit.
[4] Includes Baltic mine.

Copper produced by the Baltic mine, 1927–1931

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received	Net loss
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1927	121, 504	4, 207, 819	34. 63	13. 50	13. 42	$3, 120. 98
1928	92, 742	3, 415, 082	36. 82	14. 54	15. 01	[2] 16, 085. 53
1929	53, 833	2, 127, 926	39. 53	21. 27	17. 94	62, 339. 97
1930	(3)	3, 251, 705	49. 72	11. 82	11. 43	(3)
1931	(4)	(4)	(4)	(4)	(4)	(4)

[1] Excludes depreciation and depletion.
[2] Net profit.
[3] Figures not given.
[4] Included with Champion mine in preceding table.

Copper produced by the Trimountain mine, 1927–1931 [1]

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [2]	Price received	Net profit
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1927	67, 281	2, 354, 808	35. 00	12. 25	13. 42	$27, 476. 86
1928	38, 950	1, 275, 515	32. 74	16. 90	15. 01	[3] 24, 100. 34
1929	42, 763	1, 408, 689	32. 94	22. 92	17. 94	[3] 57, 968. 20
1930	(4)	542, 649	37. 81	16. 38	11. 43	(4)

[1] No production recorded for 1931.
[2] Excludes depreciation and depletion.
[3] Net loss.
[4] Figures not given.

At the Mohawk mine of the Mohawk Mining Co. 448,564 tons of rock were hoisted, of which 443,940 tons were stamped. The mineral produced (18,686,200 pounds) was stored at the mill and, added to the quantity stored in 1930, made a total on hand of 33,882,100 pounds of mineral estimated to contain 23,700,000 pounds of recoverable copper. Contrary to the practice at other mines in the district, operations at the Mohawk mine were on the basis of a 2-shift day and 6-day week throughout the year. This policy was dictated by the expected exhaustion of the mine within the next few years and need for the company, therefore, to operate on the most economical basis possible for the remaining life of the mine. Engineers of the company estimated that maximum production could be maintained for two years from January 1, 1932, and that decreasing production could be made for an additional two years. At the time the annual report of the company was issued (February 15, 1932) the directors were seriously considering the desirability of liquidating the company's affairs. In 1931 production costs were reduced to 7.038 cents a pound of copper, the lowest annual cost in the history of the company. Production at the mine early in 1932 was confined to No. 6 shaft. The richness of the rock in this shaft and the lowered wages of miners combined to reduce costs at that time to below 6.5 cents a pound. Dividends paid during 1931 totaled $111,700.

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[6] Koepel, Edw., Flotation of Native Copper at Freda, Mich.: Eng. and Min. Jour., vol. 131, No. 11 June 8, 1931, pp. 509–512.

Copper produced by the Mohawk Mining Co. in 1931

Rock hoisted	short tons	448, 564
Rock stamped	do	443, 940
Product of mineral	pounds	18, 686, 200
Estimated copper in mineral produced	do	13, 100, 000
Yield per ton of rock treated [7]	do	29. 508
Cost per ton of rock hoisted [7]		$1. 633
Cost per ton of rock stamped [7]		$1. 650
Operating cost per pound of refined copper [7]	cents	5. 371
Cost of taxes [7]	do	. 417
Cost of smelting, freight, and marketing product, including eastern offices' expenses [7]	cents	1. 250
		7. 038

Operations at the property of the Quincy Mining Co. were suspended on September 22, 1931, for an indefinite time, after a period of alternate work and suspension, pending possible improvement in the copper industry. The new development program at the mine was completed, and the mine is reported ready to produce at a large and steady rate when market conditions improve. Pumping and necessary timber and repair work were continued.

Copper produced by the Quincy Mining Co., 1927–1931

Year	Copper rock and mass	Mineral	Copper	Yield of copper per ton of rock
	Short tons	*Pounds*	*Pounds*	*Pounds*
1927	413, 000	15, 336, 690	9, 718, 662	23. 53
1928	60, 834	1, 891, 200	1, 220, 536	20. 06
1929	207, 833	7, 088, 500	4, 459, 426	21. 46
1930	[a] 450, 800	18, 042, 927	10, 939, 787	24. 27
1931	([b])	([b])	([b])	([b])

[a] Not given in company report but indicated by other figures.
[b] Printed annual company report not available at time of writing (July, 1932).

[7] Estimated because of storage of mineral.

MISSOURI

By J. P. Dunlop

The value of the mine production of silver, lead, and zinc in Missouri was $12,104,134 in 1931 compared with silver, copper, lead, and zinc valued at $21,089,545 in 1930. The mine production of lead in Missouri was equivalent to 41 per cent of the smelter production of primary lead from domestic sources in the United States in 1931 compared with 35 per cent in 1930. The mine production of zinc in Missouri was equivalent to 1.1 per cent of the total primary zinc produced by domestic smelters and electrolytic plants from domestic ores in 1931 compared with 22.7 per cent in 1917. About 50 mines and prospects in Missouri shipped lead or zinc concentrates in 1931.

Mine production of copper and silver in Missouri, 1927–1931

Year	Copper		Silver	
	Pounds	Value	Fine ounces	Value
1927	451,000	$59,081	233,931	$132,638
1928	65,000	9,360	176,840	103,451
1929	2,240	394	181,638	96,813
1930	176,600	$22,958	170,210	$65,531
1931	----------	----------	40,000	11,600

The only silver recovered was that from zinc residues from zinc concentrates derived from lead ores. No copper ore was shipped in 1931 or 1930 from mines in Missouri. The value of the lead and zinc from concentrates shipped from Missouri mines in 1931 was $12,092,534, a decrease of $8,908,522 from 1930.

The production of lead concentrates (of which only 440 tons were lead carbonate) was 225,547 tons compared with 278,919 tons in 1930. Of the total output 223,853 tons, a decrease of 53,667 tons, were derived from southeastern Missouri. The average lead content of the galena concentrates from this district was 72.4 per cent in 1931 compared with 73 per cent in 1930. The lead derived from galena concentrates in southeastern Missouri in 1931 was 158,950 tons, a decrease of 39,672 tons. Shipments of galena concentrates from southwestern Missouri in 1931 were 1,254 tons, an increase of 62 tons. Shipments of lead carbonate amounted to 440 tons. The lead recovered from concentrates shipped from southwestern Missouri totaled 1,171 tons. The average lead content of the galena from southwestern Missouri in 1931 was 74.6 per cent, and the average value of the galena concentrates was $41.21 per ton or $18.18 less than in 1930.

The total quantity of sphalerite concentrates from Missouri mines in 1931 was 6,008 tons, a decrease of 13,575 tons; 3,600 tons of the total output came from southwestern Missouri. The concentrates sold at an average price of $22.05 a ton and had an average zinc content of 58.6 per cent compared with an average price of $33.55 and an average assay of 60 per cent in 1930. The shipments of sphalerite concentrates from southeastern Missouri were 2,408 tons of 57.6 per cent zinc content. The shipments of zinc carbonate and silicate in 1931 came entirely from a few camps in southwestern Missouri and amounted to 377 tons or 1,319 tons less than in 1930.

The average zinc content of these concentrates was 39 per cent and the average value $12.63 per ton compared with 40.1 per cent and $24 in 1930. The value of the galena concentrates from southeastern Missouri was $9,833,045 ($6,725,875 less than in 1930); the value of the sphalerite concentrates shipped was $43,000 ($115,116 less than in 1930). The total value of the lead and zinc concentrates from southwestern Missouri declined from $497,339 in 1930 to $149,789 in 1931.

The total quantity of crude ore and old tailings treated in Missouri in 1931 was 5,240,400 tons. The total amount received for all classes of zinc and lead concentrates sold in 1931 was $10,025,834, an average of $1.91 to the ton of crude ore and old tailings treated (55 cents less than in 1930).

In the following tables, showing the tenor of ore ("dirt") and concentrates from Missouri, it has been considered advisable to segregate ores of different nature. The disseminated lead ore of southeastern Missouri differs radically from the lead and zinc ores of the so-called "soft-ground" deposits of southwestern Missouri. Each class of ore has its peculiar problems of mining and ore dressing. The data are given for the ores mined in the Joplin region, but there have been no recoveries from "sheet ground" since 1921. In general, the tables reflect very closely the conditions of the industry.

Mine production of lead and zinc in Missouri in 1931, by districts

District	Lead concentrates				Zinc concentrates			
	Galena		Carbonate		Sphalerite		Silicate and carbonate	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Aurora	5	$196	--------	--------	--------	--------	125	$1,972
Carl Junction and Cave Springs	121	4,900	--------	--------	437	$7,990	--------	--------
Granby and Diamond	126	5,307	90	$2,985	606	11,790	30	357
Joplin	437	16,758	200	6,500	167	3,143	118	1,184
Oronogo - Webb City - Carterville	321	13,988	--------	--------	180	2,839	--------	--------
Stotts City and Wentworth	29	1,409	--------	--------	257	6,825	104	1,247
Seneca and Spurgeon	150	6,500	150	4,500	--------	--------	--------	--------
Waco	--------	--------	--------	--------	1,951	46,749	--------	--------
Weaubleau and Linn Creek	65	2,615	--------	--------	2	35	--------	--------
	1,254	51,673	440	13,985	3,600	79,371	377	4,760
Southeastern Missouri	223,853	9,833,045	--------	--------	2,408	43,000	--------	--------
	225,107	9,884,718	440	13,985	6,008	122,371	377	4,760
Total, 1930	278,712	16,629,712	207	11,056	19,583	532,909	1,696	40,698

Mine production of lead and zinc in Missouri in 1931, by districts—Continued

District	Metal content [1]			
	Lead		Zinc	
	Short tons	Value	Short tons	Value
Aurora	4	$296	42	$3, 192
Carl Junction and Cave Springs	94	6, 956	226	17, 176
Granby and Diamond	150	11, 100	319	24, 244
Joplin	414	30, 636	121	9, 196
Oronogo-Webb City-Carterville	234	17, 316	89	6, 764
Stotts City and Wentworth	23	1, 702	174	13, 224
Seneca and Spurgeon	202	14, 948		
Waco			1, 013	76, 988
Weaubleau and Linn Creek	50	3, 700	1	76
	1, 171	86, 654	1, 985	150, 860
Southeastern Missouri	158, 950	11, 762, 300	1, 220	92, 720
	160, 121	11, 848, 954	3, 205	243, 580
Total, 1930	199, 632	19, 963, 200	10, 811	1, 037, 856

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[1] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in southwestern Missouri, 1928–1931

	1928	1929	1930	1931
Total ore ... short tons	281, 300	428, 400	328, 800	104, 800
Total concentrates in ore:				
Lead ... per cent	0. 56	0. 33	0. 40	1. 63
Zinc ... do	5. 47	3. 80	3. 89	3. 76
Metal content of ore:				
Lead ... do	. 41	. 25	. 31	1. 15
Zinc ... do	3. 23	2. 26	2. 25	2. 15
Average lead content of galena concentrates ... do	74. 2	76. 3	76. 0	74. 6
Average lead content of lead carbonate concentrates ... do	59. 1	60. 0	60. 0	59. 1
Average zinc content of sphalerite concentrates ... do	59. 9	60. 3	60. 0	58. 6
Average zinc content of silicates and carbonates ... do	39. 5	40. 2	40. 1	39. 0
Average value per ton:				
Galena concentrates	$75. 16	$82. 31	$59. 39	$41. 21
Lead carbonate concentrates	60. 00	61. 36	53. 42	31. 78
Sphalerite concentrates	38. 38	40. 53	33. 55	22. 05
Zinc silicates and carbonates	20. 97	21. 24	24. 00	12. 63

Tenor of lead ore and concentrates in southeastern Missouri disseminated-lead district, 1929–1931

	1929	1930	1931
Total lead ore ... short tons	6, 439, 600	6, 681, 300	5, 135, 600
Galena concentrates in ore ... per cent	4. 31	4. 15	4. 36
Zinc content of ore ... do	. 11	. 13	. 04
Average lead content of galena concentrates ... do	72. 7	73. 0	72. 4
Average value per ton of galena concentrates	$75. 61	$59. 60	$43. 93
Average zinc content of sphalerite concentrates ... per cent	58. 1	58. 2	57. 6
Average value per ton of sphalerite concentrates	$39. 44	$18. 80	$17. 86

SOUTHWESTERN MISSOURI

Area and production.—The southwestern Missouri lead and zinc areas include the largest part of the Joplin region, the remainder lying in southeastern Kansas and northeastern Oklahoma.

Lead and zinc concentrates produced in the Missouri part of the Joplin region, 1907–1931

	Short tons	Value	
		Total	Average
Lead concentrates	465, 226	$30, 062, 984	$64. 62
Sphalerite concentrates	2, 942, 994	148, 885, 393	50. 59
Zinc carbonate and silicate concentrates	308, 215	9, 490, 456	30. 79
	3, 716, 435	188, 438, 833	---------

Prices.—The following quoted base prices apply not only to concentrates from southwestern Missouri but also to those from all the mines in Oklahoma and Kansas that are in the Joplin or tri-State region, except small scattered lots of less than a carload which bring slightly lower prices. They do not apply to concentrates shipped from southeastern Missouri. The demand for high-grade sphalerite containing less than 0.20 per cent lead decreased in 1931, and it was impossible to obtain the customary $1 premium paid for this class of concentrates.

The base price for sphalerite concentrates ranged from $27 to $18 a ton in 1931. No base prices were quoted for zinc silicate; hand-cobbed zinc silicate had no market, and the quantity of milled zinc silicate had a much slacker demand than normal. The quoted prices for galena containing 80 per cent lead showed the large variation of $27.50 a ton. The opening price in January, 1931—$57.50—was the highest and the quotation in June—$30—the lowest. However, quoted prices were frequently misleading, as it was possible to sell large lots at $3 to $5 a ton above the quoted price.

The following table gives the prices at which galena concentrates (80 per cent lead) and jig and table sphalerite concentrates (60 per cent zinc) were quoted in 1931, by weeks. The price of flotation sphalerite concentrates during each week in 1931 was $1 a ton less than the quotation for jig and table sphalerite concentrates.

Quoted prices per short ton of sphalerite concentrates and galena concentrates, 1930 and 1931 [1]

Week	1930		1931	
	Sphalerite (60 per cent) concentrates	Galena (80 per cent) concentrates	Sphalerite (60 per cent) concentrates	Galena (80 per cent) concentrates
1	$35.00	$75.00	$26.00	$57.50
2	35.00	75.00	26.00	50.00
3	35.00	75.00	26.00	50.00
4	35.00	75.00	26.00	50.00
5	37.00	75.00	27.00	50.00
6	35.00	75.00	27.00	45.00
7	37.00	75.00	26.00	45.00
8	37.00	75.00	25.00	47.50
9	37.00	75.00	25.00	47.50
10	37.00	65.00	25.00	47.50
11	37.00	62.50	25.00	45.00
12	37.00	62.50	25.00	45.00
13	35.00	67.50	25.00	45.00
14	35.00	65.00	25.00	45.00
15	35.00	62.50	24.00	45.00
16	35.00	62.50	22.00	45.00
17	35.00	62.50	20.00	40.00
18	35.00	62.50	20.00	35.00
19	33.00	62.50	20.00	32.50
20	33.00	65.00	20.00	30.00
21	31.00	62.50	20.00	30.00
22	31.00	65.00	21.00	30.00
23	31.00	65.00	21.00	30.00
24	31.00	65.00	21.00	30.00
25	29.00	62.50	21.00	30.00
26	29.00	60.00	22.00	42.00
27	29.00	60.00	23.00	42.00
28	$29.00	$60.00	$23.00	$42.00
29	30.00	60.00	23.00	45.00
30	31.75	60.00	23.00	45.00
31	32.00	65.00	23.00	45.00
32	32.00	65.00	23.00	45.00
33	32.00	65.00	23.00	45.00
35	31.00	65.00	23.00	50.00
36	31.00	65.00	23.00	50.00
37	32.00	65.00	23.00	50.00
38	30.00	65.00	23.00	50.00
39	30.00	65.00	23.00	50.00
40	30.00	62.50	22.00	45.00
41	29.00	57.50	20.00	45.00
42	27.50	57.50	19.00	40.00
43	26.00	57.50	18.00	35.00
44	26.00	57.50	18.00	40.00
45	26.00	57.50	18.00	37.50
46	26.00	57.50	19.00	40.00
47	26.00	57.50	18.00	40.00
48	26.00	57.50	18.50	37.50
49	26.00	57.50	19.00	37.50
50	26.00	57.50	19.00	37.50
51	26.00	57.50	18.00	35.00
52	26.00	57.50	18.00	37.50
Average	31.50	64.13	22.19	42.30

[1] Joplin Globe, Joplin, Mo.

Average prices paid per ton for sphalerite and zinc and lead concentrates in southwestern Missouri, 1927–1931

	1927	1928	1929	1930	1931
Sphalerite	$40.08	$38.38	$40.53	$33.55	$22.05
Zinc silicate or carbonate concentrates	26.26	20.97	21.24	24.00	12.63
Galena concentrates	83.26	75.16	82.31	59.39	41.21

General conditions.—Only nine mills were operated in southwestern Missouri in 1931, and none was operated continuously. Drilling was continued near Diamond and Stotts City; but in most of the camps no drilling was done, and development was limited to shallow shafts or to scrapping in old mines. Idle miners continued to work on lead prospects, but usually they ignored all discoveries of zinc ore.

The Missouri part of the Waco camp with only one producing property shipped 54 per cent of the sphalerite. The Missouri-Kansas Zinc Corporation milled some ore during the early part of 1931 while the corporation was in the hands of receivers. The plant was finally closed and the equipment sold at public auction. The Gascho 300-ton mill at Waco was not operated in 1931. The Eldorado and other mines at Aurora produced some zinc silicate as did the New Gobbler mine at Wentworth. The Shirley D mine at Stotts City was operated for a few weeks in 1931 and was then sold to the Glendale Mining Co., which shut down the plant but continued to drill the leases.

The Easy Money Mining Co. at Diamond was the second largest shipper of sphalerite in southwestern Missouri in 1931. Other mills were operated by the Lucky Mining Co. at Carl Junction and the Little Three Mining Co. at Cave Springs; the latter was destroyed by fire. Old slag at the Eagle-Picher plant in Joplin was treated by R. M. Clark. The only output from scattered outside camps in the Missouri part of the Joplin region was small shipments of galena from Weaubleau in Hickory County and some galena concentrates that had been held in stock at Linn Creek for two years.

CENTRAL AND SOUTHEASTERN MISSOURI

Mine production of lead and zinc concentrates in southeastern and central Missouri, 1907–1931

Year	Lead concentrates (galena)		Zinc concentrates			
			Sphalerite		Carbonate and silicate	
	Short tons	Value	Short tons	Value	Short tons	Value
1907–1929	5,853,746	$382,041,252	25,335	$948,639	10,285	$233,534
1930	277,520	16,558,920	8,411	158,116	----------	----------
1931	223,853	9,833,045	2,408	43,000	----------	----------

The entire output of silver in Missouri in 1931 was derived from concentrates recovered in milling lead ores.

The lead ore (5,135,600 tons) mined in the disseminated-lead district in 1931 yielded 4.36 per cent of galena concentrates averaging 72.4 per cent lead. The average value per ton of lead concentrates was $43.93 compared with $59.60 in 1930; the output of galena concentrates was 223,853 tons compared with 277,520 tons in 1930. As the two largest producers not only mine but smelt their lead concentrates, the values given for concentrates are to a certain extent arbitrary. The galena concentrates produced in the southwestern Missouri region, which usually contain a higher lead content, are sold mainly on bids from purchasers, and the values for such concentrates are not comparable with those given for concentrates of the disseminated-lead district.

Analyses of ores mined in the disseminated-lead district in southeastern Missouri and of the various grades of resulting concentrates are given in Mineral Resources for 1919 and 1920.

No shipments of zinc carbonate from southeastern Missouri were reported in 1931, and the only sphalerite shipped was that from the flotation plants of the St. Joseph Lead Co. The average zinc content of the sphalerite concentrates shipped in 1931 was 57.6 per cent, and the average silver content was 18 to 20 ounces to the ton.

Only 200 tons of galena concentrates were shipped in 1931 by operators of shallow diggings. Most of the total was shipped to smelters by T. F. Blount, of Potosi; the rest was produced by the Annapolis Lead Co., the National Lead Co. (St. Louis), and the St. Joseph Lead Co. The Annapolis Lead Co. in Iron County ran its mine and mill part of the year, treating about half as much ore in 1931 as in 1930. The grade of the crude ore milled was better in 1931, and the lead content of the galena concentrates was higher. The property was closed at the end of the year for an indefinite time. The St. Joseph Lead Co. treated about 4,113,000 tons of ore, which yielded more than 4.5 per cent of galena concentrates and some sphalerite concentrates. Six mills with a total daily milling capacity of about 17,000 tons were operated at 75 per cent of capacity up to September 27, 1931, and thereafter to the end of December at 60 per cent. The National Lead Co. (St. Louis Smelting & Refining Co.) operated three shafts on ore mined at about 500 feet and ran the 3,500-ton mill at a slightly lower rate than in 1930.

About 39 per cent of the galena concentrates and all the sphalerite from southeastern Missouri were recovered by flotation.

The costs and methods of mining disseminated lead ore in southeastern Missouri are described in several publications issued by the Bureau of Mines.[8]

OKLAHOMA

By J. P. Dunlop

Mine shipments of lead and zinc in Oklahoma in 1931, by districts

District	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Miami	16,378	$759,285	143,404	$3,442,294	12,731	$942,094	75,728	$5,755,328
Quapaw and Sunnyside	627	27,434	4,708	98,670	479	35,446	2,404	182,704
	17,005	786,719	148,112	3,540,964	13,210	977,540	78,132	5,938,032
Total, 1930	30,626	1,980,922	263,169	7,919,524	23,052	2,305,200	136,153	13,070,688

[1] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore, old tailings, and slimes milled and concentrates produced in Oklahoma, 1930 and 1931

	1930		1931	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled...short tons	4,118,600	3,095,000	2,208,100	1,620,800
Total concentrates recovered:				
Galena...do	38,054	946	16,793	212
Sphalerite...do	215,821	52,350	123,680	24,432
Ratio of concentrates to ore, etc.:				
Lead...per cent	0.92	0.03	0.85	0.01
Zinc...do	5.23	1.70	6.56	1.74
Metal content of ore, etc.:				
Lead...do	.71	.02	.68	.01
Zinc...do	3.08	.99	3.94	1.07
Average lead content of galena concentrates...do	77.2	63.9	79.3	71.2
Average zinc content of sphalerite concentrates...do	58.9	58.4	60.3	59.5
Average value per ton:				
Galena concentrates	$65.17	$49.22	$46.21	$50.21
Sphalerite concentrates	30.91	28.49	24.30	21.90

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[8] Poston, R. H., Method and Cost of Mining at No. 8 Mine, St. Louis Smelting & Refining Co., Southeast Missouri District: Inf. Circ. 6160, Bureau of Mines, 1929, 22 pp. Sinking Practice and Costs at the Pim Shaft, St. Louis Smelting & Refining Works of the National Lead Co., St. Francois, Mo.: Inf. Circ. 6588, Bureau of Mines, 1932, 13 pp. Jackson, C. F., Methods of Mining Disseminated Lead Ore at a Mine in the Southeast Missouri District: Inf. Circ. 6170, Bureau of Mines, 1929, 21 pp.

Tenor of lead and zinc ore, old tailings, and slimes milled and concentrates produced in Oklahoma, 1928–1931

	1928	1929	1930	1931
Total ore, old tailings, and slimes milled in Oklahoma short tons	8, 028, 000	9, 324, 600	7, 213, 600	3, 828, 900
Total concentrates in ore, etc.:				
Lead per cent	0. 61	0. 55	0. 54	0. 50
Zinc do	4. 30	4. 14	3. 72	4. 43
Metal content of ore, etc.:				
Lead do	. 68	. 42	. 42	. 40
Zinc do	2. 49	2. 42	2. 19	2. 66
Average lead content of galena concentrates do	78. 4	77. 8	76. 8	79. 2
Average zinc content of sphalerite concentrates do	57. 8	58. 3	58. 8	59. 9
Average value per ton:				
Galena concentrates	$80. 79	$83. 61	$64. 68	$46. 26
Sphalerite concentrates	36. 30	38. 57	30. 09	23. 91

Mine production of lead and zinc concentrates in Oklahoma, 1891–1931, by districts

District	Lead concentrates (mainly galena)		Zinc concentrates			
			Sphalerite		Zinc silicate and carbonate	
	Short tons	Value	Short tons	Value	Short tons	Value
Davis			558	$27, 399	899	$24, 592
Miami	1, 024, 163	$89, 942, 797	5, 417, 629	224, 793, 011		
Peoria	2, 206	109, 163	220	8, 289	2, 944	76, 787
Quapaw and Sunnyside	24, 998	2, 237, 346	214, 066	8, 924, 890	164	2, 692
	1, 051, 367	92, 289, 306	5, 632, 473	233, 753, 589	4, 007	104, 071

Mineral Resources for 1914 contains a brief history of mining in the districts in Oklahoma, also the estimated total production of each district by years.

The quantity of old tailings and slimes milled in Oklahoma decreased from 3,095,000 tons in 1930 to 1,620,800 tons in 1931, but the percentage recovery of sphalerite increased. The average assay of the sphalerite from old tailings increased from 58.4 per cent in 1930 to 59.5 per cent in 1931.

The quantity of ore, old tailings, and slimes milled decreased from 7,213,600 tons in 1930 to 3,828,900 tons in 1931. The quantity milled at mines near Quapaw and Sunnyside was about 2.5 per cent of the total, compared with 3 per cent in 1930. The average zinc content of the sphalerite was 59.9 per cent in 1931, and separate assays ranged from 40 to 63 per cent. An assay of a composite sample of 2,330 lots of sphalerite shipped from the Joplin region in 1931, made by Waring & Williams, showed an average content of 60.1 per cent zinc, 1.2 per cent iron, and 0.33 per cent lead; no assay was made for cadmium, but the cadmium content probably did not vary much from that in 1930 (0.42 per cent). The 1931 assay shows that the mills made a much higher average grade of sphalerite than in 1930 and succeeded in appreciably lowering the iron and lead content. The average zinc assay, as computed from the reports of all companies in Oklahoma selling sphalerite, was 59.9 per cent.

The total quantity of lead and zinc concentrates shipped from Oklahoma in 1931 was 44 per cent less than in 1930, and the total value was 56 per cent less.

Oklahoma produced 65 per cent of the total output of zinc and lead concentrates from the Joplin region in 1931, although the Oklahoma shipments of sphalerite decreased 115,057 tons.

The value of the lead and zinc recovered from concentrates shipped from mines in Oklahoma was $6,915,572 in 1931, compared with $15,375,888 in 1930. The lead from concentrates sold decreased from 23,052 to 13,210 tons, and the zinc from sphalerite sold decreased from 136,153 to 78,132 tons. The average lead content of the galena concentrates shipped increased from 76.8 per cent in 1930 to 79.2 per cent in 1931, and the average zinc content of the sphalerite concentrates shipped increased from 58.8 to 59.9 per cent.

In 1931 about 60 mills in the Oklahoma part of the Joplin or tri-State region shipped 17,005 tons of galena concentrates and 148,112 tons of sphalerite concentrates. The average value of the galena concentrates decreased $18.42 a ton, and the average value of the sphalerite concentrates decreased $6.18 a ton. The stocks of sphalerite in mine bins were about 26,000 tons greater on December 31, 1931, than on December 31, 1930.

All the large mills and nearly all the smaller mills are equipped with flotation units, and the output from this source in 1931 was 1,400 tons of galena and 42,800 tons of sphalerite.

Most of the old tailings treated yielded little or no galena, regardless of the original content of the crude ore. The galena concentrates from old tailings are usually low in lead, although the average assay of such concentrates increased from 63.9 per cent in 1930 to 71.2 per cent in 1931.

A bulletin issued early in January, 1932, by the Tri-State Zinc and Lead Ore Producers Association stated that the average cost of producing 1 ton of zinc and lead concentrates in December, 1931, was $22.71, a reduction of about $7 a ton during the year; it must be remembered, however, that the crude ore treated in 1931 was of considerably higher grade than that milled in 1930.

The total quantity of ore and old tailings milled in the Miami part of the Joplin or tri-State region in Oklahoma and Kansas in 1931 was 5,742,100 tons, and the shipments were 24,565 tons of galena concentrates and 218,687 tons of sphalerite concentrates. These quantities do not represent the production, as considerable addition was made to stocks of galena and sphalerite held in bins at mines. More care was taken in the treatment of material sent to flotation mills so that the flotation concentrates had a much larger metal content. Mining in the Miami district, including the output by years for 1908 to 1914 and the location of the mines and mills, was reviewed in Mineral Resources for 1914. The ore deposits in the Miami district are briefly described in Mineral Resources for 1915.[9]

The shipments that may be classed as from the Cardin-Douthat area totaled 9,116 tons of galena and 104,304 tons of sphalerite. About 2,114,000 tons of ore and old tailings (1,685,300 tons of crude ore and 428,700 tons of old tailings) were treated, and the recovery in concentrates averaged 0.53 per cent for galena and 5.92 per cent for sphalerite. The old tailings in the Cardin-Douthat area yielded 26 tons of galena and 8,410 tons of sphalerite.

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[9] Siebenthal, C. E., Zinc: Mineral Resources of the United States, 1915, Pt. I, pp. 888–890.

The territory east of Picher near the Hockerville and Zincville camps was very much less productive than in 1930, when the shipments from 12 mines and 4 tailing mills amounted to 4,372 tons of galena and 44,581 tons of sphalerite; in 1931 the shipments from 9 mines and 2 tailing mills amounted to 1,190 tons of galena and 8,649 tons of sphalerite. The zinc concentrates made at the largest tailing mill were not sold in 1931.

The production of the mines near Picher also decreased. In 1930, 2,045,400 tons of ore and old tailings were milled, and the shipments amounted to 12,738 tons of galena and 75,751 tons of sphalerite. In 1931, 1,222,600 tons of ore and old tailings were milled, and the shipments were 4,984 tons of galena and 30,355 tons of sphalerite. The quantity of old tailings was slightly larger in 1931 than in 1930.

At Commerce (old Hattenville) all operations, both mining and milling, were meager and spasmodic; consequently, shipments were very small.

No mines or prospects in the old Peoria camp reported any shipment of lead or zinc concentrates.

Near Cardin and Tar River.—This area in the Miami field had the largest shipments of concentrates in 1931. The large shippers were the Adams Mining Co., O. M. Bilharz Mining Co., Commerce Mining & Royalty Co. (five mills), Consolidated Lead & Zinc Co. (Domado), Evans Wallower Lead Co., Interstate Zinc & Lead Co., Kansas Exploration Co. (Inc.), and Rialto Mining Corporation. Other shippers were the American Zinc Co. of Oklahoma, Childress & Heggen Mining Co., Davis Mining Co., and Midway Mining Co. Old tailings were milled by the B. C. Milling Co., Commerce Mining & Royalty Co. (Gosling), Myers Milling Co., and Velie Mining Corporation. The Gosling tailing mill also was operated part of 1931, but no sphalerite was shipped. The 250-ton mill of the Davis Mining Co. on the Douthat land was burned, and the mine was closed. Only a small part of the concentrates made at the Blue Goose and See Sah mills of the Commerce Mining & Royalty Co. was shipped in 1931, and the Benney mill was idle. The Evans Wallower Lead Co. was the largest shipper of concentrates from the Cardin area. The L. & G. mine was sold to the Midway Mining Co. in 1931, and the mill was operated during the last three months of the year. The Adams 500-ton mill and mining leases of the Whitney Estate were purchased by the Eagle-Picher Mining & Smelting Co., and the mill was not operated after the sale. Part of this steel mill is being utilized in the construction of the 2,500-ton plant of the Eagle-Picher Mining & Smelting Co. on the Southside land.

Near Century and Douthat.—About 81 per cent of the sphalerite concentrates and more than 88 per cent of the galena concentrates shipped from properties in this area were sold by the Admiralty Zinc Co. and the Skeleton Lead & Zinc Co. Three tailing mills were operated, and crude ore mined at the old Lucky Kid mine was hauled by truck to the Beck Mining Co. No. 1 mill near Zincville.

Near Hockerville and Zincville.—The Kropp mill was run steadily on high-grade tailings, but no concentrates were sold. The Brewster mine and mill of the Federal Mining & Smelting Co. were idle, but some sphalerite concentrates produced in 1930 were shipped. Lead and zinc concentrates were shipped in 1931 from the Blue Bonnet, Blue Ribbon, Choctaw Chief, Lucky Jenny, Santa Fe, Texas, and Toltec mines.

Near Picher.—The shippers of concentrates in 1931 were the American Zinc Co. of Oklahoma, Canam Metals Corporation, Commerce Mining & Royalty Co., Consolidated Lead & Zinc Co., Cortez King Brand Mining Co., Davis Mining Co., Eagle-Picher Mining & Smelting Co., Howe Mining Co., Jeff City Mining Co., and United Mining Co.

All the leases and mills of the Canam Metals Corporation in Oklahoma and Kansas and all the mills and leases of the Consolidated Lead & Zinc Co. were acquired by the Eagle-Picher Mining & Smelting Co., which proposes to handle the ore from its old and new properties over a new central mill; many of the old mills have already been dismantled.

The Oko mine was idle in 1931 until it was sold to the United Mining Co., which operated it during the last three months of the year.

Near Quapaw and Sunnyside.—In the eastern area of Ottawa County 76,400 tons of crude ore and 18,000 tons of old tailings were milled in 1931, and the shipments were 627 tons of galena and 4,708 tons of sphalerite. Mines of the Century Zinc Co. yielded more than 66 per cent of the output. Other shippers were the Diamond Joe Mining Co., East Side Mining Co., and White McKay Mining Co.; and several operators shipped small lots of concentrates from old properties. The only tailing mill operated in 1931 was that of the Sunflower Mining Co. on the Abrams land. The East Side Mining Co. used the old Bendene mill to treat ore from the Malsbury mine.

The following publications of the Bureau of Mines relate to mining and milling in the Joplin or tri-State region in Ottawa County, Okla.

Netzeband, W. F. Method and cost of mining zinc and lead at No. 1 mine, tri-State zinc and lead district, Picher, Okla.: Inf. Circ. 6113, Bureau of Mines, 1929, 11 pp.

——— Method and cost of mining zinc and lead at mine No. 2, tri-State district, Picher, Okla.: Inf. Circ. 6121, Bureau of Mines, 1929, 11 pp.

Samson, F. W. Milling practice at the Netta mine of the Eagle-Picher Lead Co. at Picher, Okla.: Inf. Circ. 6342, Bureau of Mines, 1930, 13 pp.

WISCONSIN

By J. P. Dunlop

Mine production of lead and zinc in Wisconsin in 1931, by districts

District	Lead concentrates		Zinc concentrates				Metal content [1]			
			Sphalerite		Carbonate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Benton-New Diggings	------	--------	64	$407	------	------	------	--------	22	$1,672
Cuba City	------	--------	19	96	------	------	------	--------	4	304
Hazel Green and Linden	328	$14,857	14,246	185,198	------	------	237	$17,538	5,198	395,048
Shullsburg	979	44,420	19,871	131,571	------	------	715	52,910	4,864	369,664
	1,307	59,277	34,200	317,272	------	------	952	70,448	10,088	766,688
Total, 1930	2,133	129,925	51,494	669,401	30	$823	1,537	153,700	12,558	1,205,568

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[1] In calculating the metal content of the ores from assays allowance has been made for roasting and smelting losses of both lead and zinc. In comparing the values of ore and metals it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in Wisconsin, 1928–1931

	1928	1929	1930	1931
Total ore.....short tons	733,500	607,100	486,400	318,700
Total concentrates in ore:				
Lead.....per cent	0.33	0.36	0.44	0.41
Zinc.....do	9.84	11.5	10.6	10.7
Metal content of ore:				
Lead.....do	.23	.26	.32	.30
Zinc.....do	3.26	3.53	3.34	3.69
Average lead content of galena concentrates.....do	71.7	72.2	73.5	74.3
Average zinc content of sphalerite concentrates.....do	33.1	30.6	31.6	34.3
Average zinc content of zinc carbonate concentrates.....do	34.0	41.6	43.0	----------
Average value per ton:				
Galena concentrates	$73.30	$76.61	$60.91	$45.35
Sphalerite concentrates	17.37	17.28	13.00	9.28
Zinc carbonate concentrates	15.92	24.60	27.77	----------

The only roasting and separating plant operated in Wisconsin in 1931 was that of the National Zinc Separating Co. at Cuba City. The shipments of concentrates came from about 10 mines, half of which operated on a very small scale. The total crude ore treated in 1931 was 318,700 tons; no old tailings were re-treated. Practically all the sphalerite concentrates were roasted except those from the Badger Zinc Co.; no shipments of zinc carbonate were reported.

The total value of the mine output of lead and zinc in Wisconsin was $837,136 in 1931, compared with $1,359,268 in 1930. As no shipments of lead or zinc concentrates were reported from mines in northern Illinois or Iowa, the output of Wisconsin represents the total output of the upper Mississippi Valley region.

Sales of galena concentrates decreased from 2,133 tons in 1930 to 1,307 tons in 1931 and sales of sphalerite concentrates from 51,494 to 34,200 tons. The quantity of lead from galena concentrates decreased 585 tons and the quantity of zinc from all concentrates 2,470 tons.

The average zinc content of the raw sphalerite concentrates from Wisconsin was 34.3 per cent and the average value $9.28 a ton in 1931, compared with 31.6 per cent and $13 a ton in 1930. The metal content of the raw sphalerite shipped in 1931 ranged from 22.8 to 62+ per cent zinc. Thirty-five per cent of the sphalerite ranged from 30 to 38 per cent zinc, and 43 per cent of the total shipments averaged less than 30 per cent.

Mines in the Shullsburg district produced 75 per cent of the galena and 58 per cent of the sphalerite in 1931. The Vinegar Hill Zinc Co. produced about 59 per cent of the total galena and 83 per cent of the total sphalerite concentrates. Very little drilling or development work was done, and several mines active in 1930 were idle in 1931.

The Vinegar Hill Zinc Co. operated the Badger mine and mill at Hazel Green and the James mine and mill at Shullsburg. The Badger Zinc Co. operated its mine and all-flotation plant at Linden, which made a good output of 62+ per cent sphalerite concentrates and also galena concentrates having a lead content of 72 per cent.

The American Mining Co., operating on leases of the Vinegar Hill Zinc Co., made large shipments from the Mullen mine. They also sank a shaft on the De Rocker land and operated it for about three months.

The Midland Development Co. did some work on the Rodham lease of the Pacquette land at Shullsburg but made no shipments as the flotation plant was not completed.

The Harmony Mining Co. built a small mill at Linden, which was not operated in 1931.

ZINC [1]

By E. W. PEHRSON [2]

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GENERAL SUMMARY

Salient figures of the zinc industry in the United States, 1930 and 1931

	1930	1931
Production of primary zinc:		
From domestic ores ... short tons	489, 361	291, 996
From foreign ores ... do	8, 684	
	498, 045	291, 996
Apparent deliveries of primary zinc to domestic consumers ... do	408, 469	312, 592
Estimated industrial use of primary and secondary slab zinc ... do	450, 900	379, 000
Stocks of zinc on hand at smelters Dec. 31 ... do	167, 293	143, 592
Ratio of electrolytic zinc to total primary zinc production ... per cent	26. 34	28. 05
Recovery of unalloyed secondary zinc ... short tons	49, 300	34, 800
Prices per pound of prime western zinc at St. Louis:		
Average for year ... cents	4. 56	3. 64
Highest monthly average ... do	5. 24	4. 03
Lowest monthly average ... do	4. 06	3. 15
Mine production of recoverable zinc ... short tons	595, 425	410, 318
Tri-State district (Joplin region) ... per cent of total	36	29
Western States ... do	33	30
Other ... do	31	41
World smelter production of zinc ... short tons	1, 540, 000	1, 116, 000

The unsatisfactory condition of the United States zinc industry in 1930 was intensified in 1931 by further decline in industrial activity. Consumption of primary and secondary slab zinc was 16 per cent below consumption in 1930 and 40 per cent below the record consumption in 1929 but exceeded that in 1921 by 44 per cent. By sharply curtailing output, producers succeeded in causing a 14 per cent reduction in stocks, which had increased rapidly during 1930, but could not realize favorable price reactions because of the unfavorable zinc situation abroad and the general chaos in the domestic metal markets.

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[1] Work on manuscript completed August, 1932.

[2] Statistics prepared (unless otherwise indicated) by H. M. Meyer, and data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

The St. Louis quotation for prime western zinc averaged 3.64 cents per pound in 1931 compared with 4.56 cents in 1930, 6.49 cents in 1929, and 4.67 cents in 1921. The opening quotation was 4.12½ cents, the highest of the year. Except for a sharp flurry upward during June and July after the debt moratorium was announced the trend was generally downward, and at the close of the year the quotation was 3.12½ cents, the low for the year. The average price at New York in 1931 was 3.99 cents, the lowest since 1896.

Primary zinc produced in the United States totaled 291,996 tons in 1931, a decrease of 41 per cent from 1930 and 53 per cent from 1929; no zinc was produced from foreign ores in 1931. Electrolytic zinc accounted for 28 per cent of the total compared with 26 per cent in 1930. Electrolytic zinc production decreased 48 per cent and distilled zinc 55 per cent from 1929. Unalloyed secondary zinc production was 29 per cent below 1930.

The apparent deliveries of primary zinc to domestic consumers decreased 23 per cent in 1931; and the industrial use of primary and secondary slab zinc, reported by the American Bureau of Metal Statistics, declined only 16 per cent, indicating further withdrawals from consumers' stocks during the year. The use of zinc in galvanizing and brass—the two principal uses—declined 23 and 18 per cent, respectively. The manufacture of rolled zinc, which ranks third in zinc consumption, increased 13.5 per cent owing to the augmented demand for fruit-jar covers that resulted from the greater popularity of home canning of bumper crops during hard times.

Mine production of zinc decreased 31 per cent in 1931. The Central and Western States, with decreases of 44 and 36 per cent, respectively, accounted for most of the curtailment. The Eastern States produced only 7 per cent less zinc than in 1930 and replaced the Central States as the principal zinc-producing region of the United States; New Jersey replaced Oklahoma as the leading State. Production in New York and Washington increased substantially.

World smelter production of zinc decreased 28 per cent in 1931, with the largest tonnage decreases in the United States, Germany, Poland, Belgium, France, and Great Britain. Norway, Russia, and Mexico made substantial gains. There was a large increase in world stocks of zinc.

The European zinc cartel, which collapsed at the close of 1929, was revived in July, 1931. Production was limited to 55 per cent of an agreed capacity basis, but as the reduced output failed to effect the expected reduction in zinc stocks a further curtailment to 50 per cent of rated capacity was agreed upon, effective December 1.

The London price of zinc declined from an average of 2.76 cents per pound in January to 2.16 cents in December. The average for the year was 2.52 cents, the lowest on record and 1.12 cents below the St. Louis average.

A striking example of the severity of the decline in industrial activity in the United States compared with the rest of the world is afforded by a study of zinc production and consumption figures for

1925 to 1929 (average) and for 1931. During that period mine production in the United States decreased 43 per cent, whereas the rest of the world decreased only 20 per cent. Similarly, smelter production fell off 52 per cent in the United States and only 22 per cent elsewhere, and consumption of slab zinc was 45 per cent lower in the United States and only 4.5 per cent elsewhere.

PRODUCTION

The statistical procedure followed by the Bureau of Mines in collecting and collating figures on zinc production has been explained in detail in preceding reports of this series. The following table shows the quantity and value of domestic primary, foreign primary, and redistilled secondary zinc produced in the United States by plants that operate ordinarily on primary materials and by plants that treat only secondary materials in large graphite retorts.

Domestic and foreign primary and redistilled secondary zinc produced in the United States, 1927–1931

Year	Domestic primary		Foreign primary		Redistilled secondary		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	576,960	$73,851,000	15,556	$1,991,000	42,784	$5,476,000	635,300	$81,318,000
1928	591,525	72,166,000	11,056	1,349,000	48,666	5,937,000	651,247	79,452,000
1929	612,136	80,802,000	13,311	1,757,000	47,348	6,250,000	672,795	88,809,000
1930	489,361	46,979,000	8,684	834,000	[1] 34,849	3,345,000	532,894	51,158,000
1931	291,996	22,192,000	----------	------------	[2] 21,625	1,643,000	313,621	23,835,000

[1] Includes 22 tons of secondary electrolytic zinc. [2] Includes 312 tons of secondary electrolytic zinc.

PRIMARY ZINC

The term "primary zinc," as used herein, refers only to zinc produced from ores or from the immediate by-products of primary reduction operations. The following table shows the primary zinc produced in the United States from 1927 to 1931, apportioned according to source of ore and locality at which reduced.

Primary zinc produced in the United States, 1927–1931, in short tons

APPORTIONED ACCORDING TO SOURCE OF ORE

Year	Domestic [1]	Foreign (all Mexico)	Total	Year	Domestic [1]	Foreign (all Mexico)	Total
1927	576,960	15,556	592,516	1930	489,361	8,684	498,045
1928	591,525	11,056	602,581	1931	291,996	----------	291,996
1929	612,136	13,311	625,447				

APPORTIONED ACCORDING TO LOCALITY AT WHICH REDUCED

Year	Arkansas	Idaho	Illinois	Kansas	Montana	Oklahoma	Pennsylvania	Other States	Total
1927	26,317	----------	102,768	33,144	112,629	120,801	106,099	90,758	592,516
1928	20,505	1,939	103,765	33,923	158,221	106,557	108,802	68,869	602,581
1929	17,923	16,582	112,425	37,795	138,019	111,683	108,167	82,853	625,447
1930	13,917	9,509	103,331	13,682	112,908	79,742	101,916	63,040	498,045
1931	3,362	8,466	76,290	4,660	63,090	26,924	65,445	43,759	291,996

[1] The slab zinc that was rolled is included here.

The production of primary zinc from domestic sources in the United States in 1931 decreased 197,365 tons (40 per cent) from 1930. Unlike preceding years, no zinc was produced from foreign ores in 1931.

Illinois was the leading producer of metallic zinc in 1931, although the output was 26 per cent less than in 1930 and 32 per cent less than in 1929. Pennsylvania was second, but production decreased 36 per cent. Montana, formerly the leading producer, dropped to third place, with a decrease in production of nearly 44 per cent. Production in all other producing States decreased materially; the output of Oklahoma dropped from 79,742 tons in 1930 to 26,924 tons in 1931 (over 66 per cent).

The production of primary zinc by the retort process decreased 43 per cent and by the electrolytic process 38 per cent in 1931.

DISTILLED AND ELECTROLYTIC ZINC

The total production of primary and secondary electrolytic and distilled zinc, apportioned by method of reduction and by grade, is shown in the following table:

Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1927-1931, in short tons

APPORTIONED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled primary	Redistilled secondary [1]	Total
1927	112, 629	479, 887	42, 784	635, 300
1928	160, 160	442, 421	48, 666	651, 247
1929	156, 235	469, 212	47, 348	672, 795
1930	131, 166	366, 879	[2] 34, 849	532, 894
1931	81, 898	210, 098	[3] 21, 625	313, 621

APPORTIONED ACCORDING TO GRADE

Year	Grade A (high grade)	Grade B (intermediate)	Grade C (brass special)	Grade D (selected)	Grade E (prime western)	Total
1927	150, 933	40, 121	72, 104		372, 142	635, 300
1928	197, 675	41, 779	73, 957		337, 836	651, 247
1929	207, 321	27, 430	96, 163		341, 881	672, 795
1930	156, 494	26, 079	93, 270		257, 051	532, 894
1931	83, 445	23, 924	73, 274		132, 978	313, 621

[1] For total production of secondary zinc see p. 272.
[2] Includes 22 tons of secondary electrolytic zinc.
[3] Includes 312 tons of secondary electrolytic zinc.

The table shows electrolytic zinc production decreased 38 per cent in 1931 compared with 16 per cent in 1930. In 1931 production of primary distilled zinc decreased 43 per cent compared with 22 per cent in 1930. Recovery of redistilled secondary zinc decreased 38 per cent in 1931; 40 per cent of the total was produced at primary and 60 per cent at secondary smelters. The quantity produced at primary smelters declined 42 per cent and at secondary smelters 35 per cent. Production of all grades of zinc decreased in 1931, but the decline was chiefly in "high grade" and "prime western."

High grade.—In 1931, 27 per cent of the total zinc produced was high grade; and, according to the prices quoted in the American Metal

Market, the monthly average premium was about 0.65 cent per pound for the year compared with 1.02 cents in 1930.

Intermediate.—In 1923 production of intermediate-grade zinc amounted to nearly 59,000 tons but in 1931 decreased to 23,924 tons. This grade of zinc commands a premium of about one-half cent a pound over prime western.

Brass special.—The production of brass special zinc, including a small tonnage of selected grade, decreased from 100,000 tons in 1924 to 74,000 tons in 1928, increased to 96,000 tons in 1929, and dropped to 73,274 tons in 1931. The premium on brass special in 1931 ranged from 0.05 to 0.10 cent and averaged 0.094 cent per pound over prime western.

Selected.—Only a relatively small quantity of the selected grade of zinc is produced, and the tonnage is included with the production of brass special. The premium on this grade is about 5 cents per 100 pounds.

Prime western.—Prime western zinc is the most common grade and the principal product of retort smelters. In 1925 this grade constituted 60 per cent of the total output but in 1931 had decreased to 42 per cent.

ROLLED ZINC

The accompanying tables show the quantity and value of rolled zinc produced in the United States from 1927 to 1931. The total production in 1931 was 58,335 tons (14 per cent more than in 1930 but 32 per cent less than in 1926). As stated, the rise in 1931 is largely attributable to the increased demand for glass-jar covers in canning. The largest part of the decrease during the previous four years may be ascribed to declining demand for dry cells following widespread adoption of "socket-power" radio receivers. The American Bureau of Metal Statistics states that the consumption of rolled zinc in the manufacture of dry batteries decreased from 30,908 tons in 1926 to 12,208 tons in 1931 (61 per cent). The total value of the rolled zinc produced was 4 per cent less in 1931 than in 1930 and 54 per cent less than in 1926.

Imports of sheet zinc into the United States since 1923 have been negligible. Exports in 1931 decreased 29 per cent from 1930 and comprised 5 per cent of the total United States production.

Zinc rolled in the United States, 1927–1931

Year	Pounds	Value		Year	Pounds	Value	
		Total	Average			Total	Average
1927	148, 259, 718	$13, 671, 530	$0. 092	1930	102, 769, 995	$8, 671, 408	$0. 084
1928	147, 061, 670	12, 364, 908	. 084	1931	116, 669, 925	8, 313, 383	. 071
1929	136, 667, 203	12, 105, 177	. 089				

Rolled zinc available for consumption in the United States, 1930 and 1931

	1930			1931		
	Pounds	Value		Pounds	Value	
		Total	Average		Total	Average
Sheet zinc not over 0.1 inch thick	37,512,635	$3,376,194	$0.090	30,935,389	$2,581,635	$0.084
Boiler plate and sheets over 0.1 inch thick	1,771,412	148,608	.084	1,092,858	89,567	.082
Strip and ribbon zinc	63,485,948	5,146,606	.081	84,641,678	5,642,181	.067
Total zinc rolled	102,769,995	8,671,408	.084	116,669,925	8,313,383	.071
Sheet zinc imported for consumption	130,870	6,420		39,352	2,283	
Rolled zinc exported	7,735,247	761,007	.098	5,518,392	461,130	.084
Available for consumption	95,165,618			111,190,885		
Slab zinc, grades B, C, and D			.047			.037
Spread			.037			.034

A substantial quantity of zinc foil was produced in 1931, but as yet the market for this product is limited because of its dull finish and its effect on foods.

The quoted base price of sheet zinc, carload lots, f. o. b. rolling mills, ranged from 8.75 to 9 cents per pound during 1931. These quotations, however, are subject to discounts which may fluctuate, whereas the base quotations remain steady. The average price actually received by rolling mills reporting to the Bureau of Mines was 7.1 cents for all classes of rolled zinc compared with 8.4 cents in 1930, a drop of 15 per cent. The average price of the grades of slab zinc used in rolling mills decreased to 3.7 cents in 1931, so that the value added by rolling was 3.4 cents per pound in 1931 compared with 3.7 cents in 1930 and 2.4 cents in 1929.

The companies reporting production of rolled zinc in the United States in 1931 were the same as for the preceding year and are listed on page 438 of Zinc in 1930.

ZINC DUST

Commercial production of zinc dust in the United States began in 1910 and reached a maximum in 1920, when it was about 11,500 tons. From 1922 to 1927 the annual production averaged about 8,000 tons. In 1931, 10,611 tons were produced, 15 per cent more than in 1930.

Zinc dust [1] sold by producers in the United States, 1927–1931

Year	Short tons	Value		Primary zinc recovered as zinc dust (short tons) [2]
		Total	Average per pound	
1927	8,098	$1,345,105	$0.083	3,249
1928	9,172	1,475,875	.080	2,668
1929	11,050	1,864,672	.084	[3] 3,263
1930	9,237	$1,205,740	$0.065	2,559
1931	10,611	1,148,152	.054	[3] 2,820

[1] In 1927 "blue powder" only was produced. From 1928 to 1931 some "atomized" dust also was produced, but the Bureau of Mines is not at liberty to publish the figures separately.

[2] The amount of secondary zinc recovered in zinc dust, 1928–1931, is shown in the table on secondary zinc, p. 272.

[3] Includes a small quantity of zinc in dust made from slab zinc

The following companies reported the production and sale of zinc dust in 1931:

Producers of zinc dust in the United States in 1931

	Location of plant
The Alloys Co	San Francisco, Calif.
American Smelting & Refining Co	Sand Springs, Okla.
Do	Reading, Pa.
Federated Metals Corporation	Trenton, N. J.
John Finn Metals Works	San Francisco, Calif.
Grasselli Chemical Co	Meadowbrook, W. Va.
New Jersey Zinc Co	Palmerton, Pa.
Superior Zinc Corporation	Philadelphia, Pa.

ZINC PIGMENTS AND SALTS

Zinc oxide, leaded zinc oxide, and lithopone are the principal pigments of zinc, and the chloride and sulphate are the principal salts. These products are manufactured from various zinciferous materials—ores, metal, and secondary substances. In 1931 the total zinc content of all zinc pigments and salts produced in the United States was 123,554 tons (20 per cent less than in 1930) and was derived from the following sources:

Zinc content of zinc pigments and salts made in the United States, 1927–1931, by sources, in short tons

Source	1927	1928	1929	1930	1931
Domestic ore: [1]					
For pigments	121,899	123,964	137,147	103,298	73,944
For salts	867	806	957	1,263	588
	122,766	124,770	138,104	104,561	74,532
Metal	34,012	37,588	39,620	27,090	26,223
Secondary materials	[2] 24,986	[2] 26,861	26,795	22,304	22,799
	[2] 181,764	[2] 189,219	204,519	153,955	123,554

[1] Includes some zinc derived from primary drosses from zinc-reduction plants.
[2] Revised figures.

The use of zinc ore and metallic zinc in the manufacture of pigments and salts decreased 29 and 3 per cent, respectively, in 1931, whereas the use of secondary material increased 2 per cent.

Ore was used in the manufacture of the following pigments and salts in 1931, the percentages representing the proportion of the total recoverable zinc content of the ore used in each product: American process zinc oxide, 64 per cent; lithopone, 23 per cent; leaded zinc oxide, 12 per cent; and zinc salts, 1 per cent.

Practically all the metallic zinc was used in the manufacture of French process zinc oxide.

The secondary zinc was distributed as follows: Lithopone, 66 per cent; zinc salts, 31 per cent; and zinc oxide and leaded zinc oxide, 3 per cent.

Further details of the production of zinc pigments and salts are given in the Mineral Resources chapter, Lead and Zinc Pigments and Salts.

SECONDARY ZINC

Secondary zinc production as reported by the Bureau of Mines includes zinc recovered from industrial scrap and junk, except that zinc recovered in the same plant in which the industrial scrap is made is excluded. The accompanying table, compiled in large part by J. P. Dunlop of the Bureau of Mines, shows the quantity of secondary zinc recovered in the United States as metal and in zinc dust, zinc pigments, and zinc salts, 1928 to 1931.

Secondary zinc recovered in the United States, 1928–1931, in short tons

	1928	1929	1930	1931
Secondary zinc, redistilled	48,666	47,348	[1] 34,849	[2] 21,625
Secondary zinc, remelted	22,034	18,052	14,451	13,175
Total secondary zinc recovered unalloyed	70,700	65,400	49,300	34,800
Recovered zinc in alloys, excluding old brass remelted	12,500	11,600	7,700	7,400
Recovered zinc in remelted brass (estimated)	66,000	65,670	42,300	30,000
Total secondary zinc recovered as metal	149,200	142,670	99,300	72,200
Secondary zinc recovered in zinc dust	5,600	6,700	5,800	6,700
Secondary zinc recovered in pigments	14,900	16,000	15,000	16,000
Secondary zinc recovered in zinc salts	[3] 12,000	10,800	7,300	7,100
Total secondary zinc recovered	[3] 181,700	176,200	127,400	102,000

[1] Includes 22 tons of secondary electrolytic zinc.
[2] Includes 312 tons of secondary electrolytic zinc.
[3] Revised figures.

The recovery of secondary zinc decreased 20 per cent in 1931 and was the lowest output since 1921. Production of domestic primary zinc decreased 40 per cent.

Secondary zinc recovered in the form of metal decreased 27 per cent, due to decreases of 38 per cent in redistilled secondary zinc, 9 per cent in remelted zinc, 4 per cent in alloys other than old brass, and 29 per cent in remelted brass; that recovered in dust, pigments, and salts increased 6 per cent.

BY-PRODUCT SULPHURIC ACID

The following table gives the total quantity and value of sulphuric acid of different strengths produced and sold by plants associated with zinc-blende roasting operations.

By-product sulphuric acid produced at zinc-blende roasting plants in the United States, 1928–1931

	1928	1929	1930	1931
Number of establishments	21	21	21	21
Acid reported as 50°–60° B.:				
Produced (expressed as 60° B.) short tons	643,407	694,990	548,660	390,278
Consumed at works (expressed as 60° B.) do	32,680	33,474	28,206	16,375
Sold (expressed as 60° B.) do	618,010	657,785	518,665	373,254
Value of acid sold—				
Total	$6,109,459	$6,336,444	$4,996,275	$3,278,509
Average	$9.89	$9.63	$9.63	$8.78
Acid reported as 66° B. and stronger:				
Produced (expressed as 66° B.) short tons	384,445	482,507	385,038	347,964
Consumed at works (expressed as 66° B.) do	34,742	67,670	51,314	46,473
Sold (expressed as 66° B.) do	365,596	441,617	352,886	294,034
Value of acid sold—				
Total	$5,077,475	$6,381,556	$4,867,536	$3,884,404
Average	$13.89	$14.45	$13.79	$13.21
Total acid sold, equivalent in 60° B.:				
Quantity short tons	1,056,725	1,187,726	942,128	726,094
Value	$11,186,934	$12,718,000	$9,863,811	$7,162,913
Total acid consumed at works (60° B.) short tons	74,370	114,678	89,783	72,142

The total production of sulphuric acid (60° B.) at zinc-blende roasting plants in 1931 was 807,834 tons, 20 per cent less than in 1930 and about 15 per cent of the total output of sulphuric acid in the United States.

The quantity of acid sold by zinc plants in 1931 was 23 per cent less than in 1930. The average price received for 60° B. acid was $0.85 per ton lower than in 1930. The average sales price of 66° B. and stronger acids decreased 4 per cent. The total value of all sales decreased 27 per cent. Sales of 60° B. acid decreased 28 per cent and production 29 per cent. Sales of 66° B. acid decreased 17 per cent and production 10 per cent. Statistics indicate that producers' stocks of 60° B. acid remained constant and those of 66° B. acid increased slightly in 1931.

The following statement shows the quantity of blende and sulphur used and the quantity and value of the acid made from each.

Production and value of sulphuric acid made from blende and sulphur at zinc-blende roasting plants in the United States, 1930 and 1931

	1930	1931
Number of establishments	21	21
Blende used ... short tons	565,092	439,243
Acid made, equivalent in 60° B ... do	536,614	426,618
Value at average of sales of 60° B	$5,167,593	$3,745,706
Sulphur used ... short tons	125,740	[1] 100,956
Acid made, equivalent in 60° B ... do	474,092	[2] 381,216
Value at average of sales of 60° B	$4,565,506	$3,347,077
Total quantity of acid made (60° B.) ... short tons	1,010,706	807,834
Total value of acid made	$9,733,099	$7,092,783

[1] Includes small quantity of pyrites.
[2] Includes acid made from small quantity of pyrites.

In 1931, as in 1930, 53 per cent of the acid made at zinc plants was derived from blende and 47 per cent from sulphur. Twenty-two per cent less blende was used, and 20 per cent less acid was made from blende in 1931 than in 1930. Acid made from blende in 1931 was 10 per cent of the total production of the United States. The quantity of sulphur used at zinc plants decreased 20 per cent in 1931, and the acid produced therefrom decreased 20 per cent.

A list of operators in 1931, with the location of their acid plants, follows. Plants at zinc smelters are also indicated in the list of zinc-reduction plants on page 276. The American Zinc Oxide Co. of Columbus, Ohio, has a zinc-roasting plant and disposes of the sulphur gases to the neighboring plant of the Farmers Fertilizer Co. The Hillsboro plant of the American Zinc Co. of Illinois was idle during 1931. The new plant of the St. Joseph Lead Co. at Josephtown, Pa., which began production in December, 1930, operated at about 30 per cent capacity during 1931; zinc concentrates are obtained from company mines in New York.

Producers of by-product sulphuric acid at zinc-blende roasting plants in the United States in 1931

	Location of plant
American Steel & Wire Co	Donora, Pa.
American Zinc & Chemical Co	Langeloth, Pa.
American Zinc Co. of Illinois	East St. Louis, Ill.
American Zinc Oxide Co	Columbus, Ohio

	Location of plant
Eagle-Picher Lead Co	Hillsboro, Ill.
Grasselli Chemical Co	Grasselli, Ind.[3]
Do	Canton, Ohio.
Do	Cleveland, Ohio.
Do	Lockland, Ohio.
Do	Niles, Ohio.
Do	New Castle, Pa.
Hegeler Zinc Co	Danville, Ill.
Illinois Zinc Co	Peru, Ill.
Matthiessen & Hegeler Zinc Co	La Salle, Ill.
Mineral Point Zinc Co	Depue, Ill.
Monsanto Chemical Co	East St. Louis, Ill.
National Zinc Co. (Inc.)	Bartlesville, Okla.
National Zinc Separating Co.[4]	Platteville, Wis.
New Jersey Zinc Co. (of Pennsylvania)	Palmerton, Pa.
St. Joseph Lead Co	Josephtown, Pa.
United Zinc Smelting Corporation	Moundsville, W. Va.

MINE PRODUCTION

The following table shows the mine production of zinc in the United States, by States, during the past five years.

Mine production of recoverable zinc in the United States, 1927–1931, in short tons

State	1927	1928	1929	1930	1931
Arizona	1,134	639	1,229	815	
Arkansas	128	86	9		
California	4,031				80
Colorado	35,865	35,731	29,431	36,259	16,187
Idaho	26,778	31,263	45,675	37,649	19,569
Illinois	521	17	31	9	
Kansas	109,427	107,251	109,850	74,304	39,051
Kentucky	860	92			
Missouri	18,737	12,974	11,017	10,811	3,205
Montana	80,231	82,830	68,176	26,421	6,747
Nevada	3,172	3,398	8,460	14,584	10,431
New Jersey	95,695	99,871	103,740	97,626	94,285
New Mexico	29,802	31,203	34,455	32,765	27,866
New York	3,750	11,257	10,250	22,471	24,100
Oklahoma	206,611	180,252	192,042	136,153	78,132
Oregon				6	
Tennessee	10,400	[1] 32,917	[1] 40,558	[1] 48,147	[1] 38,312
Utah	49,593	46,929	51,510	44,495	37,291
Virginia	8,325	(1)	(1)	(1)	(1)
Washington	640	43	1,059	352	4,974
Wisconsin	32,841	18,417	16,986	12,558	10,088
	718,541	695,170	724,478	595,425	410,318

[1] Bureau of Mines not at liberty to publish figures for Virginia after 1927. These figures are included in the total for Tennessee.

The mine production of zinc in the United States in 1931 was 410,318 tons, a decrease of 31 per cent from 1930. Production in the Eastern and Southern States decreased only 7 per cent, whereas that in the Mississippi Valley and Western States decreased 44 and 36 per cent, respectively. In 1931 the Mississippi Valley States produced 32 per cent of the total, Western States 30 per cent, and Eastern and Southern States 38 per cent. In 1930 the proportions were 39, 33, and 28 per cent, respectively.

The output of the tri-State district (Joplin region) decreased 45 per cent in 1931; it was 91 per cent of the total for the Mississippi Valley States and 29 per cent of the total for the country. The 1931 output of the district amounted to only 28 per cent of the 1926 output and was 30 per cent below the 1921 output.

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[3] Acid made from sulphur only; no blende used in 1931.

[4] Acid made chiefly from partly desulphurized pyrite tailings from magnetic separating plant.

The four principal producing States furnished the following percentages of the country's total in 1931: New Jersey 23 per cent, Oklahoma 19 per cent, Kansas 10 per cent, and Utah 9 per cent. Production in all States except New York, Washington, Tennessee, and California decreased in 1931; but the decreases were not pronounced in New Jersey, New Mexico, and Wisconsin. Washington's output increased as a result of further developments in the Metaline Falls district; New York's increase was due to increased output in the Edwards district; and California's output was negligible.

Detailed information concerning the mining activities in the various districts of the United States appears in the chapters of this volume dealing with the mine production of gold, silver, copper, lead, and zinc in the various States. The following table shows zinc production in the principal zinc-mining districts in the United States from 1926 to 1930:

Mine production of recoverable zinc in the principal zinc-producing districts of the United States, 1926–1930, in short tons

District	State	1926	1927	1928	1929	1930
Joplin region	Kansas, Missouri, Oklahoma.	423,800	330,530	297,020	309,436	216,961
New Jersey	New Jersey	80,629	95,695	99,871	103,740	97,626
Eastern Tennessee	Tennessee	12,098	10,400	32,917	40,558	48,147
Austinville	Virginia	5,830	8,325			
Coeur d'Alene region	Idaho	26,267	26,131	28,665	43,046	33,145
St. Lawrence County	New York	5,041	3,750	11,257	10,250	22,471
Bingham	Utah	25,381	24,549	22,246	21,794	22,362
Park City region	do	16,518	22,428	23,785	27,965	19,543
Willow Creek	New Mexico	---------	21,223	23,205	22,865	16,638
Central	do	7,164	5,038	7,545	11,224	15,319
Battle Mountain	Colorado	3,818	3,900	1,400	420	14,272
Summit Valley (Butte)	Montana	71,653	78,314	73,948	50,550	13,984
Upper Mississippi Valley	Iowa, Northern Illinois, Wisconsin.	29,377	33,362	18,434	17,017	12,567
Leadville	Colorado	11,162	11,845	14,802	13,414	11,519
Pioche	Nevada	3,759	1,219	2,685	6,498	11,086
San Juan Mountains	Colorado	14,565	17,165	17,371	14,403	10,434
Eureka	do	11,212	11,435	12,714	11,429	9,839
Southeastern Missouri region.	Missouri	1,092	4,245	3,457	3,473	4,307
Barker	Montana	---------	4	174	3,885	3,227
Warm Springs	Idaho	---------	636	2,115	2,488	3,073
Tybo	Nevada	---------	---------	---------	1,303	2,261
San Francisco	Utah	56	47	115	644	1,727
Flint Creek	Montana	223	168	1,273	2,607	1,660
Deadwood Basin	Idaho	---------	---------	---------	136	1,428
Yellow Pine	Nevada	1,105	1,773	713	618	1,237
Magdalena	New Mexico	4,007	2,215	170	127	735
Oro Blanco	Arizona	---------	---------	528	(1)	727
Rico	Colorado	2,981	5,308	4,646	2,953	595
Cataract	Montana	160	79	366	1,297	484
Tintic	Utah	4,200	526	21	526	476
Rush Valley	do	981	1,817	695	523	358
Metaline	Washington	33	468	---------	1,031	352
Tomichi	Colorado	434	228	250	64	21
Breckenridge	do	1,890	2,514	1,765	955	---------
Northport	Washington	464	172	43	17	---------
Kentucky-Southern Illinois.	Kentucky-Illinois	1,838	860	92	---------	---------
New Placers	New Mexico	617	1,223	73	---------	---------
Ophir	Utah	185	196	52	---------	---------
Shasta County	California	8,899	3,356	---------	---------	---------
Catalina Island	do	1,262	676	---------	---------	---------
Warren	Arizona	2,944	434	---------	---------	---------
Bell	Nevada	456	143	---------	---------	---------
Eureka	Arizona	1,975	71	---------	---------	---------

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[1] Bureau of Mines not at liberty to publish figures.

FLOTATION CONCENTRATES

The following table shows the production of zinc flotation concentrates in the United States, exclusive of the tri-State district, from 1927 to 1931.

Zinc flotation concentrates produced in the United States, exclusive of the tri-State district, 1927–1931 [1]

Year	Concentrates (short tons)	Zinc content		Lead content	
		Short tons	Tenor, per cent	Short tons	Tenor, per cent
1927	500, 932	265, 807	53. 06	12, 316	2. 46
1928	559, 626	298, 638	53. 36	17, 441	3. 12
1929	564, 274	306, 906	54. 39	15, 303	2. 71
1930	519, 476	282, 888	54. 46	11, 047	2. 13
1931	373, 747	205, 380	54. 95	5, 080	1. 36

[1] Year Book, American Bureau of Metal Statistics, 1931.

ZINC-REDUCTION PLANTS

ZINC SMELTERS

Disturbed industrial conditions and the introduction in 1929 of large continuously operated vertical retorts have sharply curtailed activities during the past few years at plants using horizontal-type retorts. At the end of 1925 there were 25 active smelters, operating 95,460 retorts; and by the end of 1929 the number had decreased to 20 active plants, using 62,722 retorts. On December 31, 1931, there were only 10 active smelters, using 19,875 retorts, decreases of 79 and 68 per cent compared with the number of retorts in use at the end of 1925 and 1929, respectively. At the beginning of 1931 there were 15 active smelters, using 34,558 retorts (47 per cent of the available retorts in these plants), so that during the year the number of retorts in use declined 42 per cent. Only 37 per cent of the regular retorts in plants operating at the end of 1931 were in use.

At the end of 1931, 40 continuously operated vertical retorts had been installed, but data are not available on the number in operation.

The following table shows the primary zinc-smelting plants in the United States at the end of 1931:

Primary zinc-smelting plants in the United States at end of 1931

Operating company (A=acid plant located at the smelter)	Location of plant	Regular horizontal retorts	Large vertical retorts
ARKANSAS			
Athletic Mining & Smelting Co.[1]	Fort Smith	3, 328	
Van Buren Zinc Co.[2]	Van Buren	3, 200	
ILLINOIS			
American Zinc Co. of Illinois (A)	East St. Louis	5, 760	
Hegeler Zinc Co. (A)	Danville	5, 400	
Illinois Zinc Co. (A)	Peru	3, 200	
Matthiessen & Hegeler Zinc Co. (A)	La Salle	6, 324	
Mineral Point Zinc Co. (A) [1]	Depue	5, 912	8

[1] Horizontal retort plant idle Dec. 31, 1931.
[2] Idle since 1927.

Primary zinc-smelting plants in the United States at end of 1931—Continued

Operating company (A=acid plant located at the smelter)	Location of plant	Regular horizontal retorts	Large vertical retorts
INDIANA			
Grasselli Chemical Co.[3]	Terre Haute	4,200	
KANSAS			
American Steel & Wire Co.[1]	Cherryvale	5,160	
OKLAHOMA			
Blackwell Zinc Co. (Inc.) [3]	Blackwell	9,600	
Eagle-Picher Mining & Smelting Co.[1]	Henryetta	4,800	
National Zinc Co. (Inc.) (A)	Bartlesville	4,256	
Nicholson Corporation [3]	Kusa	3,760	
Quinton Spelter Co. [1]	Quinton	3,360	
PENNSYLVANIA			
American Steel & Wire Co. (A)	Donora	7,904	
American Zinc & Chemical Co. (A)	Langeloth	4,864	
New Jersey Zinc Co. (of Pennsylvania) (A)	Palmerton	7,200	16
TEXAS			
American Smelting & Refining Co	Amarillo	6,400	
WEST VIRGINIA			
Grasselli Chemical Co.[1]	Meadowbrook	6,720	16
United Zinc Smelting Corporation (A)	Moundsville	2,368	
Total retorts		103,716	40
Number of retorts in use at end of year		19,875	(4)
Per cent of total		19.2	(4)

[1] Horizontal retort plant idle Dec. 31, 1931.
[3] Idle throughout 1931.
[4] Data not available.

During 1931 the United States Steel Corporation through its subsidiary, the American Steel & Wire Co., purchased the plant of the Edgar Zinc Co. at Cherryvale, Kans. The Matthiessen & Hegeler Zinc Co. added 48 retorts to its plant at La Salle, Ill. The new electrothermic plant of the St. Joseph Lead Co. at Josephtown, Pa., was completed and put into operation in January, 1931, but activities were confined to the production of zinc oxide for market.

In addition to the primary zinc smelters listed in the foregoing table the Missouri Zinc Co. has a smelter at Beckemeyer, Ill. This plant formerly treated ores, but in recent years has been operated on secondary materials exclusively. The plant contains 1,032 regular horizontal retorts and was idle at the close of 1931. Other secondary smelters which produced zinc in large graphite retorts in 1931 were:

Birmingham Smelting & Refining Co., Birmingham, Ala.
General Smelting Co., Philadelphia, Pa.
Nassau Smelting & Refining Co., Tottenville, N. Y.
Superior Zinc Corporation, Philadelphia, Pa.
Trenton Smelting & Refining Branch of Federated Metals Corporation, Trenton, N. J.
Wheeling Steel Corporation, Wheeling, W. Va.

ELECTROLYTIC PLANTS

Operations were greatly curtailed at electrolytic zinc plants in 1931. Of a total of 2,220 cells available, only 675 were operating at the end of the year. The Anaconda plant of the Anaconda Copper Mining Co. and the East St. Louis plant of the Evans-Wallower Zinc Co. were shut down during the year.

The following table summarizes data on electrolytic zinc plants in the United States.

Electrolytic zinc plants in operation in the United States in 1931

Company	Location	Year completed	Number of cells	Estimated annual capacity in short tons of cathode zinc [1]
Anaconda Copper Mining Co	Great Falls, Mont	1916 and later enlarged	1,164	126,000
Do	Anaconda, Mont	1928	576	63,000
Sullivan Mining Co	Kellogg, Idaho	1928	300	23,400
Evans-Wallower Zinc Co	East St. Louis, Ill	1929	180	19,000

[1] Year Book, American Bureau of Metal Statistics, 1931.

WORLD ASPECTS

WORLD MINE PRODUCTION

Compilation of the world mine production of zinc is difficult, because there are no published data for some countries and reports from those that do publish production data lack uniformity. The following table, compiled from official and semiofficial sources, is submitted as a partial record of world mine production during the past five years. Supplementary data, based partly on estimates, are given in the yearbooks of the American Bureau of Metal Statistics and the Metallgesellschaft.

World mine production of zinc, 1927–1931, in metric tons [1]

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1927	1928	1929	1930	1931
North America:					
Canada [2]	75,067	83,754	89,478	121,400	107,612
Mexico	137,724	161,747	174,050	124,106	120,307
Newfoundland		7,000	34,000	39,000	39,000
United States [3]	651,846	630,644	657,232	540,158	372,232
	864,637	883,145	954,760	824,664	639,151
South America:					
Bolivia (exports)	5,637	2,261	1,395	6,028	14,670
Chile	1,003	499	38	1	1
Peru	21,589	28,587	23,686	[4] 11,222	[4] 104
	28,229	31,347	25,119	17,251	14,775
Europe:					
Austria	3,502	3,156	3,960	3,557	697
Belgium	7,000	[5] 6,000	[5] 5,000	[5] 4,000	[5] 4,000
Bulgaria [6]	(6)	(6)	(6)	(6)	(6)
Czechoslovakia	848	528	8	642	1,384
Finland	1,189	660	380	224	(7)

[1] Figures represent estimated content of ores or concentrates produced, except as otherwise noted.

[2] Smelter production plus estimated content of ores and concentrates exported.

[3] Production of recoverable zinc.

[4] Content of sales and shipments.

[5] Approximate production

[6] Production of ore reported as follows: 1927, 1,495 tons of zinc ore and 6,720 tons of lead-zinc ore; 1928, 2,340 tons of zinc ore and 14,762 tons of lead-zinc ore; 1929, 1,925 tons of zinc ore and 11,396 tons of lead-zinc ore; 1930, 2,762 tons of lead-zinc ore; 1931, data not available. No data available on zinc content.

[7] Data not available.

World mine production of zinc, 1927–1931, in metric tons—Continued

Country	1927	1928	1929	1930	1931
Europe—Continued.					
France	8,600	9,300	9,870	7,400	(7)
Germany	141,629	144,386	142,467	138,653	104,000
Great Britain	1,272	720	864	657	200
Greece	6,110	4,476	5,855	3,743	(7)
Hungary [8]	(8)	(8)	(8)	(7)	(7)
Italy	85,393	84,840	86,940	79,528	47,090
Norway	108	22	1,446	5,586	7,422
Poland	108,000	100,000	112,000	124,000	63,000
Portugal	153	----------	----------	----------	(7)
Russia [9]	[10] 2,300	[10] 10,500	[10] 10,700	[10] 18,000	(7)
Spain	47,057	44,906	50,909	48,620	36,069
Svalbard	15	----------	----------	----------	----------
Sweden	24,372	14,172	29,992	29,973	25,000
Yugoslavia	325	345	340	4,600	(7)
	[10] 437,873	[10] 424,011	[10] 460,731	[10] 469,183	(7)
Asia:					
China [6]	10,000	4,100	11,200	3,800	3,000
Chosen [11]	(11)	(11)	(11)	(11)	(7)
India, British [12]	27,508	32,901	30,760	30,678	(7)
Indo-China	21,800	21,486	18,760	15,900	8,040
Japan [6]	10,000	10,000	10,000	10,000	10,000
Russia [9]	(10)	(10)	(10)	(10)	(7)
Turkey	----------	2,000	4,000	5,000	(7)
	[10] 69,308	[10] 70,487	[10] 74,720	[10] 65,378	(7)
Africa:					
Algeria	21,513	15,098	14,943	8,000	4,000
Egypt	306	----------	587	300	(7)
Kenya Colony	(13)	----------	----------	----------	----------
Morocco, French (exports)	71	259	1,040	309	424
Nigeria	10	61	----------	12	----------
Rhodesia—					
Northern Rhodesia	----------	13,387	22,587	19,790	(7)
Southern Rhodesia	----------	165	----------	----------	----------
Tunisia	7,800	3,500	4,000	700	500
	29,700	32,470	43,157	29,111	(7)
Oceania:					
Australia	174,283	150,236	157,043	121,533	75,403
New Caledonia	450	----------	420	700	(7)
	174,733	150,236	157,463	122,233	(7)
	1,604,000	1,592,000	1,716,000	1,528,000	(7)

[6] Approximate production.

[7] Data not available.

[8] Production of zinc-lead ore reported as follows: 1927, 400 tons; 1928, 1,000 tons; 1929, 600 tons. No data available on zinc content.

[9] Year ended Sept. 30.

[10] Output from Russia in Asia is included under Russia in Europe.

[11] Production of zinc ore reported as follows: 1927, 3,684 tons; 1928, 5,322 tons; 1929, 5,109 tons; 1930, 3,831 tons. No data available on zinc content.

[12] Estimated zinc content of concentrates produced by the Burma Corporation (Ltd.) in Burma.

[13] Production of 12 tons of zinc ore reported, zinc content not stated.

The following table shows trends of mine production in the principal zinc-producing countries. Figures for 1931 are based partly on estimates, as official figures are not yet available. It is estimated that world production in 1931 was 30 per cent less than the average for the 5-year period, 1925 to 1929. The countries most seriously affected by the depression are Australia, Poland, the United States, Italy, Spain, and Germany. Comparing the two periods mentioned above it is noted that production in the United States declined 43 per cent and that in the rest of the world only 20 per cent. Production in Canada during 1931 was 47 per cent above the average output from 1925 to 1929. Production in Mexico was fairly well maintained.

The total output of the British Empire in 1931 was below the 5-year average, but its relative importance to the world total increased from 17 per cent in 1925 to 1929 to 23 per cent in 1931. On the other hand, production in the United States declined from 42 to 34 per cent in the same period. The increasing importance of the British Empire in zinc production has been due largely to increased production in Canada and Newfoundland.

Recent trends in mine production of zinc in the principal producing countries of the world

Country	Per cent of world total			Index [1925–1929 average=100]	
	1925–1929 average	1930	1931	1930	1931
United States	42.0	35.4	33.9	82	57
Australia	9.9	8.0	6.9	78	49
Mexico	8.0	8.1	11.0	98	95
Germany	7.7	9.1	9.5	115	86
Poland	7.3	8.1	5.7	108	55
Italy	5.1	5.2	4.3	99	59
Canada	4.7	7.9	9.8	166	147
Spain	3.2	3.2	3.3	97	72
All others	12.1	15.0	15.6	121	90
World total	100.0	100.0	100.0	98	70
British Empire	17.2	21.8	23.1	124	94

WORLD SMELTER PRODUCTION

The following table shows world smelter production of zinc from 1927 to 1931, as far as statistics are available. Official figures are used wherever possible. The figures for countries for which official data are not yet available are taken from the Year Book of the American Bureau of Metal Statistics and other reliable sources, but official statistics will be substituted as received.

Duplication is always possible in figures for European production, as some countries send poor-quality crude zinc to other countries for refining. Furthermore, secondary zinc probably is included in production figures reported by some foreign countries. The data for such countries are therefore not fully comparable with those for production of primary zinc in the United States, as given in the following table:

World smelter production of zinc, 1927–1931, in metric tons, by countries where smelted

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1927	1928	1929	1930	1931
Australia	49,944	51,029	52,705	55,782	54,696
Belgium	199,090	206,300	197,900	176,230	138,000
Canada	66,413	74,176	78,061	110,219	107,612
Czechoslovakia	6,324	8,039	10,675	13,472	7,947
France	79,583	92,463	87,330	90,700	62,900
Germany [1]	84,100	98,100	102,000	97,300	45,300
Great Britain	42,541	56,284	59,234	49,378	21,582
Indo-China	1,170	2,887	3.808	3,857	2,900
Italy	7,367	10,654	15,804	19,264	16,913
Japan	17,498	19,117	22,099	24,669	[2] 25,000
Mexico	6,432	11,220	15,099	29,377	35,248
Netherlands	26,268	26,857	25,712	23,255	19,323
Northern Rhodesia	----------	9,751	12,316	18,194	7,038
Norway	5,488	----------	5,516	34,611	42,000
Poland	150,299	161,815	169,029	174,362	130,756
Russia	[3] 2,266	[3] 2,246	[3] 3,437	[3] 4,650	11,400
Spain	16,531	13,549	11,825	10,697	10,094
Sweden	4,647	5,106	4,718	4,126	[2] 4,000
United States	537,519	546,649	567,393	451,816	264,893
Yugoslavia	3,185	4,883	6,291	5,514	4,439
	1,307,000	1,401,000	1,451,000	1,397,000	1,012,000

[1] Exclusive of secondary material (Metallgesellschaft). The figures, published by the Stat. Reichsamt, which include secondary material, are as follows: 1927, 89,837 tons; 1928, 104,707 tons; 1929, 108,429 tons; 1930, 101,385 tons. Figures for 1931 not yet available.

[2] Approximate production.

[3] Year ended Sept. 30.

The world smelter production of zinc in 1931 was 1,012,000 metric tons and represented decreases of 28 per cent from the 1930 output and 30 per cent from the record 1929 production. The output in the United States decreased 41 per cent, whereas the total production elsewhere decreased only 21 per cent. The American Bureau of Metal Statistics estimates the 1931 output at 1,012,682 tons and Metallgesellschaft at 998,800 tons.

Of the 20 countries for which zinc production was recorded in 1931, 9 showed decreases of over 20 per cent, 3 decreases from 10 to 20 per cent, 3 substantial increases, and 5 relatively small changes. The United States, Germany, Poland, Belgium, France, and Great Britain, in the order named, had the largest tonnage decreases. Small decreases were recorded in Canada and Australia. Norway, Russia, and Mexico made substantial gains in production. The British Empire produced 19 per cent of the world's metallic zinc in 1931 compared with 17 per cent in 1930.

Production of electrolytic zinc held up better than that of retort zinc. According to the American Bureau of Metal Statistics production of electrolytic zinc amounted to 330,674 metric tons in 1931, a decrease of 17 per cent from 1930. Production of retort zinc decreased 32 per cent. Electrolytic zinc accounted for 33 per cent of the world total in 1931 and 28 per cent in 1930. Canada, with 33 per cent of the world total, replaced the United States as the principal producer in 1931.

Electrolytic zinc production decreased 38 per cent in the United States but only 8 per cent in foreign countries. Australia, Norway, France, Italy, Poland, and Northern Rhodesia produce important quantities.

WORLD CONSUMPTION

World consumption of slab zinc in 1931 was estimated by the American Bureau of Metal Statistics at 1,061,800 metric tons compared with 1,280,600 tons in 1930 and 1,462,100 tons in 1929. The 1931 consumption was 17 per cent below that in 1930 and 27 per cent below that in 1929. The trend of zinc consumption during the past few years in the principal zinc-consuming areas of the world appears in the following table:

Recent trends in consumption of slab zinc in the principal zinc-consuming areas of the world [1]

Area	Metric tons			Index [1925–1929 average=100]		Per cent of world total		
	1925–1929 average	1930	1931	1930	1931	1925–1929 average	1930	1931
By countries:								
United States	516,560	395,600	285,300	77	55	38.8	30.9	26.9
Germany	177,980	183,500	151,300	103	85	13.4	14.3	14.2
Great Britain	175,860	170,600	149,100	97	85	13.2	13.3	14.0
France	114,180	130,700	116,600	114	102	8.6	10.2	11.0
Belgium	111,960	123,000	117,300	110	105	8.4	9.6	11.1
Japan	48,060	44,900	44,700	93	93	3.6	3.5	4.2
Russia	26,000	42,300	47,000	163	181	2.0	3.3	4.4
All others	159,180	190,000	150,500	119	95	12.0	14.9	14.2
World total	1,329,780	1,280,600	1,061,800	96	80	100.0	100.0	100.0
By continents:								
Europe	717,380	791,800	692,300	110	97	53.9	61.8	65.2
North and South America	540,620	420,100	302,800	78	56	40.7	32.8	28.5
Asia	54,460	53,700	54,700	99	100	4.1	4.2	5.2
Australia	15,620	13,000	10,000	83	64	1.2	1.0	.9
Africa	1,700	2,000	2,000	118	118	.1	.2	.2

[1] Based on data shown on p. 81 of the 1931 Year Book of the American Bureau of Metal Statistics.

The tonnages in the preceding table generally represent production plus imports minus exports. Variations in stocks in most of the principal consuming countries, other than the United States, are not considered, so that trends for the various countries are not precisely comparable. Nevertheless, the data indicate the severity of curtailment in the United States, compared with elsewhere. World consumption in 1931 was 267,980 tons less than the average for the 5-year period 1925 to 1929. Of this total the United States accounted for 231,260 tons (86 per cent). Consumption of zinc in 1931, compared with the average for the 5-year period 1925 to 1929, declined 45 per cent in the United States but only 4.5 per cent in the rest of the world. This comparison, however, is somewhat exaggerated, as the consumption shown for the United States has been adjusted for variations in stocks whereas that shown for most of the other countries has not been adjusted for increased stocks. Many of the other countries accumulated considerable zinc stocks during 1930 and 1931, so that the consumption shown is excessive. Exact data on accumulations of stocks in most of the countries, other than the United States, are not available.

WORLD ZINC INDUSTRY

Summaries of the zinc industry in the important zinc-producing countries follow.

AUSTRALIA

Australia ranked fifth in mine production and sixth in smelter production of zinc in 1931. The zinc content of ores produced in 1931 totaled 74,212 long tons, a decrease of 38 per cent from 1930. Usually about two-thirds of the zinc ore mined is shipped to European smelters and one-third is treated at the electrolytic zinc plant at Risdon, Tasmania, but owing to curtailed production during the past two years these proportions have not been maintained. The production of metallic zinc in 1931 was 53,832 tons, a decrease of only 2 per cent from 1930 and more than the output of any year prior to 1930.

A very large part of the zinc production of Australia is exported. In 1931, 43,026 tons of zinc in the form of ore and 56,558 tons of metallic zinc were exported. Exports of ore were less than half of the 1930 shipments and only 35 per cent of those in 1928. Exports of metallic zinc, however, exceeded all previous records and were nearly double the 1930 shipments; Great Britain took 50 per cent of the 1931 exports, Belgium 22 per cent, and Japan 18 per cent. The greater part of the zinc ore goes to Great Britain.

The excess of exports over production in 1931 probably was derived from stocks accumulated under the British Board of Trade contract which terminated in 1930. Under this contract Australian zinc concentrates were purchased at considerably above the open-market price. Total purchases by the British Government to March 31 1931, were £13,057,000. The loss to the Government was £8,104,000 The average cost f. o. b. Port Pirie under the whole contract was 92s. 9d. per ton of concentrate and the average loss 57s. 6d. per ton. Sales in 1930–31 averaged only 19s. 2d. per ton. At the termination of the contract it was stated that 200,000 tons of concentrates were stored in Australia.

All the ore produced in 1931 came from the Broken Hill district. The Zinc Corporation (Ltd.), Broken Hill South (Ltd.), and North Broken Hill (Ltd.) were the only companies operating in 1931; they treated 872,202 tons of ore, from which were obtained 172,079 tons of lead concentrates and 125,736 tons of zinc concentrates; the latter contained 66,124 tons of zinc, 2,339 tons of lead, and 223,504 ounces of silver. In 1930, six companies treated 1,305,280 tons of ore. The ore treated in 1931 contained approximately 15 per cent lead, 12 per cent zinc, and 7 ounces of silver to the ton. Mill recoveries of 95 per cent of the lead, 85 per cent of the zinc, and 91 per cent of the silver and improved grades of concentrates are being obtained.

Owing to extremely low zinc prices only one company was producing zinc concentrates at the beginning of the year, and the continued decline in metal prices threatened to cause a complete shutdown of all activities in the district. This was averted, and zinc production was resumed by all active companies after adjustments in wages and freight rates. Another favorable factor was the 39 per cent decline in the exchange rate on Australian currency (United States gold basis) during 1931, which largely mitigated the effect of falling metal prices.

As a result of low zinc prices no zinc was produced by Tasmanian mines, and plans for the development of zinc production at Mount Isa and Lake George have been abandoned temporarily.

BELGIUM

Belgian zinc smelters in 1931 produced 138,000 metric tons, a decrease of 22 per cent from 1930. These smelters depend upon imported ores, domestic ores furnishing less than 2 per cent of the total production. In 1931, 383,000 tons of ore were imported; Sweden, Mexico, British India, Italy, and Australia were the principal contributors. Belgium is one of the leading exporters of zinc and in 1931 exported 57,000 tons of slab zinc, etc., including scrap, of which France took 46 and Germany 25 per cent. More than 47,000 tons of zinc in the form of sheets, wire, etc., were exported in 1931; exports of slabs, etc., decreased 6 per cent and of sheets, etc., 15 per cent in 1931.

The largest zinc producer in Belgium and one of the largest in the world is the Société Anonyme de la Vieille Montagne. This company owns mines in many parts of the world and operates 3 zinc smelters in Belgium, 2 in France, and 1 in Germany. It also operates an electrolytic zinc plant in France. During 1931 the company produced 83,636 tons of zinc (8 per cent of the world total) compared with 113,000 tons in 1930. The 1931 output was exceeded only by that of the Consolidated Mining & Smelting Co. of Canada and by the combined outputs of the Anaconda Copper Mining Co. and its Polish subsidiary, Giesche Spólka Akcyjna. The company closed its smelter in Germany in March, and operations at the Belgian plants were curtailed to meet the cartel's requirements. The company's largest mine is at Åmmeberg, Sweden. According to a statement of the managing director, dated May 7, 1932, the introduction of the flotation process at this mine has made possible profitable production at zinc prices then prevailing.

CANADA

Canada ranked third in mine production of zinc in 1931 with an output of 118,623 short tons (11 per cent less than in 1930). Production in 1931 was confined to two Provinces; British Columbia supplied 85 per cent and Manitoba 15 per cent. Production in British Columbia decreased 19 per cent, whereas that in Manitoba increased over nine times. Quebec and Ontario, which contributed substantial quantities in 1930, failed to produce in 1931.

Much of the zinc ore mined is smelted in Canada. Only 18 per cent of the total output of ore was exported in 1930, and no ore was exported in 1931. Most of the metallic zinc is exported; shipments were 119,000 tons in 1931 compared with 75,500 tons in 1930, indicating a sharp reduction in stocks for the year. Great Britain took 62 per cent, Japan 9 per cent, Germany 7 per cent, and France 6 per cent of the 1931 shipments. Europe absorbed most of the increase in exports in 1931.

Practically all the Fort Steele district output comes from the Sullivan mine of the Consolidated Mining & Smelting Co. of Canada (Ltd.). During 1931, 1,621,143 tons of ore were produced, or about 300,000 tons less than in 1930. The low costs of 1930 were maintained in 1931 in spite of reduced output and without increasing production in the higher-grade sections of the ore body.

The concentrator feed contained 8 pounds less lead and 5.6 pounds more zinc per ton than in 1930, and the tailings contained 1.6 pounds less lead and 0.2 pound more zinc per ton. Mining costs of concentrating ore were reduced 16.3 per cent and milling costs 8.8 per cent, so that the per-pound cost of recoverable metal declined 14.3 per cent. Operations resulted in a deficit of over $700,000, after provision for depletion and depreciation, compared with a profit of nearly $2,800,000 in 1930.

The operations of the zinc fuming plant, which was completed in 1930, were entirely satisfactory. The plant makes possible the recovery of 23 per cent more zinc and 4 per cent more lead from the ore, at a cost less than that of the cheapest metal made direct from Sullivan ore. The zinc roasting plant was completely converted to the new Trail concentrate-burning process in 1931.

All the zinc production of Manitoba was derived from the Flin Flon mine of the Hudson Bay Mining & Smelting Co. (Ltd.), which came into production in the latter part of 1930. During 1931, 1,090,596 tons of ore averaging 0.089 ounce of gold and 1.09 ounces of silver to the ton, 1.94 per cent copper, and 3.82 per cent zinc were mined and milled, from which were produced 73,000 ounces of gold, 702,128 ounces of silver, 31,068,556 pounds of copper, and 35,056,199 pounds of zinc. The zinc, which is produced in the company electrolytic zinc plant, averaged 99.9865 per cent zinc. The total cost of operation was $3.13 per ton of ore milled. Original estimates of costs and efficiencies were either equaled or bettered. The profit-and-loss account for 1931 showed an operating profit of $1,376,620 before deductions for interest, amortization, and depreciation.

Sherritt-Gordon, another potential zinc producer of northern Manitoba, continued copper production in 1931. All plans for zinc production were suspended in 1930.

FRANCE

France ranked fifth in world smelter production of zinc in 1931 with an output of 62,900 metric tons, a decrease of 31 per cent from 1930. The smelting industry depends largely on foreign ore, of which 191,516 tons were imported in 1931. Spain, Mexico, Sweden, and Italy were among the principal contributors. In 1930 the mines of France produced only 8 per cent of the smelted output.

France imports large quantities of slab zinc to supply the domestic consumption. In 1931, 55,896 tons were imported; Belgium supplied over half.

GERMANY

Germany ranked seventh in smelter production in 1931 with an output of 45,300 metric tons, a decrease of 53 per cent from 1930. Imports of slab zinc increased from 109,600 tons in 1930 to 118,500 tons in 1931 and exports decreased from 23,500 to 12,500 tons, so that the apparent consumption declined only 18 per cent. Of the 1931 imports, Poland supplied 49 per cent, Australia 10 per cent, Belgium and Netherlands 8 per cent each, Canada 6 per cent, and the United States 4 per cent. There was a large decrease in shipments from Poland whereas imports from Australia, Canada, and the United States showed large increases.

Normally the mines of Germany produce enough zinc to supply the smelters; but as the smelting industry is in western and central Germany where the large Upper Silesian ore production is not available, Germany exports large quantities of ore from Upper Silesia to the neighboring Polish smelters and imports large quantities of slab zinc therefrom. The smelters of western Germany are supplied partly by imported ore, and a substantial quantity of slab zinc is in turn exported. In 1931 Germany exported 126,901 tons of ore; 83 per cent went to Poland. Imports of ore were 84,411 tons, 36 per cent from Russia and 29 per cent from Mexico.

The German zinc industry was hard hit in 1931. As the price of zinc declined the ore supply dwindled, and the custom smelters were forced to compete for the supply with French and Belgian smelters which were favored with cheaper labor and fuel. Abandonment of the gold standard by Great Britain proved advantageous to zinc producers in countries where currency was linked to sterling. By the end of the year only three out of eight smelters in Germany were operating, and each reported large losses for the year. There was much demand for a protective tariff on slab zinc; but the zinc-mining companies demanded similar protection on zinc ore, and the consuming industries opposed imposition of any tariff. The Government had taken no action to the end of 1931.

During the first half of 1932 the situation was further aggravated by imposition of the British tariff. In March the Government was empowered to impose a supertariff of 200 marks per ton on zinc imported from countries which had no trade treaty with Germany. Such countries included Australia, Canada, and Poland. The tariff became effective on April 1, but apparently the duty was imposed only on Canadian zinc. The new Government, which came into power in May, was reported to favor a broad tariff on zinc; but when the principal zinc-mining companies announced their intention of closing down, the Government, instead, decided to grant subsidies to the mining companies to avoid further unemployment. According to press reports the Government was to advance 6,000,000 marks to privately owned zinc and lead mines up to March, 1933, the advances to be returned at a later date. No action on the zinc tariff was contemplated.

GREAT BRITAIN

Great Britain consumed 14 per cent, smelted only 2 per cent, and mined less than 0.1 per cent of the world's zinc in 1931. Compared with 1930 consumption declined 13 per cent and smelter production 56 per cent. Imports of slab zinc increased from 135,000 long tons in 1930 to 146,000 tons in 1931; shipments from Canada and Australia showed large increases whereas those from the United States, Belgium, and Germany decreased. Exports of zinc totaled 11,000 tons compared with 9,000 tons in 1930. The smelting industry of Great Britain requires importation of large quantities of zinc ore. In 1930, the latest year for which figures are available, 154,000 tons were imported, Australia being the main source of supply.

The smelter of the Sulphide Corporation was shut down in January, 1931, owing to low metal prices. The Zinc Manufacturing Co. (Ltd.) decided to produce crude zinc oxide instead of slab zinc for the British market in its new Coley process plant at Dartford.

Abandonment of the gold standard in September, 1931, had no appreciable effect on the British zinc trade; but the imposition of a 10 per cent tariff on March 1, 1932, virtually excluded non-British zinc from Great Britain in April and May.

ITALY

The mines of Italy in 1931 produced zinc ore containing 47,090 metric tons of zinc, a decrease of 41 per cent from 1930. Smelter production was fairly well maintained, amounting to nearly 17,000 tons compared with 19,000 tons in 1930. Owing to the curtailment in mine production the exportable surplus of ores declined; exports (ore) were 68,500 tons compared with 144,600 tons in 1930. Belgium and France are the principal consumers of the zinc ores. The 29 per cent decline in the consumption of slab zinc resulted in a decrease in imports from about 6,000 tons in 1930 to about 2,000 tons in 1931.

In June, 1931, the Government appropriated 7,000,000 lire ($368,000 at par) as a subsidy to the Sardinian mines to relieve unemployment.

MEXICO

Mexico ranked second in mine production of zinc with an output of 120,307 metric tons (11 per cent of the world total), a decrease of 3 per cent from 1930; however, Mexico's smelter output increased from 29,377 to 35,248 tons and was the highest on record. Exports of slab zinc increased from 17,033 tons in 1930 to 40,133 tons in 1931, indicating a substantial reduction in stocks for the year. Exports of zinc ore were 149,000 tons in 1931 compared with 206,000 tons in 1930. Belgium, France, and Germany are the principal importers of Mexican zinc ore. The only active zinc smelter in Mexico is the Rosita plant of the American Smelting & Refining Co. The capacity of this plant was increased greatly in 1930.

POLAND

The zinc industry of Poland suffered a severe decline in 1931. Mine production was only 63,000 metric tons (49 per cent less than in 1930), and smelter production totaled 130,756 tons (25 per cent less). Polish smelters treat large quantities of imported ore, mostly from the German portion of the Upper Silesian zinc field. Most of the slab zinc produced in Poland is exported. In 1931 shipments were 107,000 tons, Germany taking over half. Exports in 1931 were 20 per cent less than in 1930.

The largest zinc producer in Poland is Giesche Spólka Akcyjna, a subsidiary of the Anaconda Copper Mining Co. Production of slab zinc by this company decreased from 72,000 tons in 1930 to 54,000 tons in 1931.

EUROPEAN ZINC CARTEL

A discussion of the European zinc cartel is given in the report of this series for 1930. The discussion covered events occurring through September, 1931.

The following chronology of events from September, 1931, to July, 1932, is based largely upon reports appearing in the press.

September.—At the Brussels meeting on September 29 it was announced that members' stocks had been reduced by 8,000 tons during August. Satisfaction was expressed with results so far.

October.—At the Paris meeting on October 22 a further curtailment in production of 5 per cent, effective December 1, was agreed upon, limiting production to 50 per cent of the basis set forth in the Ostend agreement. This move was necessitated by the continued shrinkage in consumption and the unsatisfactory stock situation. Stocks of zinc held by cartel members on October 31 were reported at 191,000 metric tons.

November, 1931, to June, 1932.—The existence of the cartel was threatened several times by various political events, such as abandonment of the gold standard by Great Britain, the imposition of British tariffs, and the demand for tariff protection in Germany. During March it was reported that a complete shutdown for two months was demanded by some members, whereas other members were requesting increased production quotas; nevertheless, the organization continued to exist. Stocks of cartel members had been reduced to 169,000 tons on June 15, 1932. Monthly production by cartel members had declined from 51,700 tons in November, 1931, to 46,676 tons in May, 1932, indicating that the official restricted output, about 47,000 tons per month, was being adhered to closely.

July.—On July 12 at a meeting held at Ostend it was agreed to further curtail production, effective August 1, by 5 per cent, or to 45 per cent of the capacity specified in July, 1931, thus restricting the monthly output by cartel members to about 42,000 tons. This action discredited rumors that the cartel was about to break up.

TARIFF

The tariff act of 1930, effective June 18, 1930, established import duties of 1¾ cents per pound on slab zinc, 1½ cents per pound on the zinc content of ores, and 2 cents per pound on sheet zinc. The tariff does not apply to pyrites containing not more than 3 per cent zinc or to the zinc content of lead and copper ores which is not actually recovered.

IMPORTS AND EXPORTS

IMPORTS

The following tables give the Bureau of Foreign and Domestic Commerce record of zinc imports into the United States from 1927 to 1931 and a record of bonded-warehouse inventories.

The chief zinc import of the United States normally is zinc ore, largely imported under bond so that it can be smelted and the metallic zinc therefrom reexported without import duties. In 1931 only 780 tons of zinc in ore were imported, a decrease of 97 per cent from 1930. Domestic producers did not report the production of any zinc from foreign ores in 1931.

The United States imports very little slab zinc, rolled zinc, and manufactured zinc products. In 1931 the total value of these imports was $30,799, of which $13,591 represented the value of manufactured products. A considerable amount of old brass is imported, chiefly from Canada, which supplied 82 per cent of the total quantity in 1931. The decrease in imports in 1931 probably resulted from the continued low price of copper more than from the low price of zinc.

Zinc ore and old brass (fit only for remanufacture) imported into the United States, 1927–1931

[General imports]

Year	Zinc content of zinc ore (short tons)				Old brass	
	Canada	Mexico	Other countries	Total	Short tons	Value
1927	217	9, 285	11	9, 513	3, 993	$556, 064
1928 [1]	18	1, 646	3	1, 667	6, 075	1, 015, 172
1929	848	13, 563		14, 411	7, 031	1, 371, 655
1930	13	25, 644	182	25, 839	3, 573	535, 761
1931	(2)	778	2	780	2, 212	215, 430

[1] Figures probably incomplete.
[2] Less than 1 ton.

Zinc remaining in warehouse in the United States, December 31, 1927–1931

Year	Ore and calamine		Blocks, pigs, and old		Zinc sheets	
	Zinc content (pounds)	Value	Pounds	Value	Pounds	Value
1927	12, 287, 028	$592, 206				
1928	8, 719, 290	797, 923				
1929	3, 758, 809	113, 479				
1930	27, 185, 311	784, 670			43, 334	$2, 081
1931	22, 377, 439	269, 019	22, 909	$160	71, 089	2, 896

Zinc imported for consumption in the United States, 1927–1931

Year	Blocks or pigs		Sheets		Old		Zinc dust		Value of manufactures	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1927	39	$5,089	1	$271	19	$1,443	(1)	$114	$91,519	$98,436
1928	(1)	66	3	2,556	3	260	146	14,147	115,784	132,813
1929	226	21,502	(1)	52	(1)	20	159	19,543	128,395	169,512
1930	281	25,389	65	6,420	[2] 35	[2] 1,968	76	7,086	76,062	116,925
1931	274	14,793	20	2,283	(1)	35	1	97	13,591	30,799

[1] Less than 1 ton.
[2] Includes 33 tons of dross and skimmings, valued at $1,829, imported June 18 to Dec. 31; not separately recorded prior to change in tariff.

EXPORTS

The total value of the 1931 exports of zinc ore and domestic and foreign manufactures of zinc (not including galvanized products, alloys, and pigments) was approximately $736,000, a decrease of 50 per cent from 1930 and of 96 per cent from the recent high in 1925.

The following table shows the principal zinc exports of the United States during the past five years.

Domestic zinc ore and domestic manufactures of zinc exported from the United States, 1927–1931

Year	Zinc ore and concentrates		Pigs or slabs [1]		Plates and sheets		Zinc dross		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1927	46,716	$1,690,523	45,695	$6,035,382	3,922	$869,425	4,451	$296,489	1,357	$259,209
1928	4,518	205,978	25,289	3,013,679	4,325	906,515	3,148	240,613	1,008	199,081
1929	71	2,434	14,411	1,879,039	5,265	1,075,000	3,490	217,019	1,256	250,447
1930	--------	-----------	4,633	450,417	3,868	761,007	1,162	57,288	1,177	194,252
1931	13	373	643	51,010	2,759	461,130	382	19,218	1,400	204,277

[1] Includes slab zinc made from foreign ore. Not separately recorded.

For many years, through 1929, slab zinc was the largest single item of zinc exports, but in 1930 and 1931 plates and sheets led. In fact, plates and sheets accounted for 90 per cent of the value of the two items in 1931. Less than 650 tons of slab zinc, valued at about $51,000, were exported in 1931, 86 per cent less in quantity and 89 per cent less in value than in 1930. Exports of slab zinc have declined 99 per cent since 1925, due to increased production in Europe and to the inability of American producers to compete in European markets at the low prices of the last few years. Exports to North American countries in 1931 decreased 98 per cent, to European countries 85 per cent, and to South American countries 88 per cent; exports to Asia increased due to shipments to India.

A considerable quantity of foreign zinc smelted in bond in the United States is exported each year; after 1923, quantities shipped have not been reported separately but have been included with domestic exports. It is believed that during the past few years virtually all of the slab zinc exported has been derived from foreign ores.

The following table shows the destination of the exports of zinc ore, slab zinc, and sheet zinc in 1930 and 1931:

Domestic zinc ore and domestic and foreign manufactures of zinc exported from the United States, 1930 and 1931, by destinations, in short tons

Destination	Ore and concentrates [1]	Slabs, blocks, or pigs		Sheets, strips, etc.	
	1931	1930	1931	1930	1931
North America:					
Canada	10	846	7	1,508	1,087
Cuba			2	46	23
Mexico		214	4	103	28
Panama			8	27	38
Other		17	2	92	21
	10	1,077	23	1,776	1,197
South America:					
Argentina		60		214	144
Brazil		1		48	23
Chile		1,115	144	7	2
Colombia		1		10	6
Peru		6	1	14	5
Other		3	(2)	21	15
		1,186	145	314	195
Europe:					
Belgium		283			2
France				34	13
Germany		564	79	20	3
Italy		224		2	(2)
Netherlands		588		36	23
Sweden	3			23	19
United Kingdom		640	235	1,193	957
Other		51	40	22	4
	3	2,350	354	1,330	1,021
Asia:					
China				31	46
India (British)			112	4	1
Japan				194	232
Philippine Islands		11	9	157	41
Other		9		31	19
		20	121	417	339
Africa				1	1
Oceania, including Australia				30	6
	13	4,633	643	3,868	2,759

[1] No ore and concentrates exported in 1930.
[2] Less than 1 ton.

Exports of plates and sheets decreased from 3,868 tons in 1930 to 2,759 tons in 1931 (29 per cent), and from $761,007 to $461,130 (39 per cent). This decrease was distributed among the countries importing American plates and sheets roughly in proportion to the quantities accepted in 1930. Although Canada and the United Kingdom received 74 per cent of the zinc plates and sheets exported from the United States in 1931, shipments to these two countries decreased 24 per cent.

Exports of zinc ore and concentrates were negligible in 1931; none were exported in 1930. Exports of zinc dross decreased 67 per cent in quantity and 66 per cent in value in 1931 as compared with 1930. Exports of zinc dust increased 19 per cent in 1931, probably due to increased gold production in which zinc dust serves as a precipitant. Mexico took 62 per cent of the total in 1927 and 1928, 55 per cent in 1929, 46 per cent in 1930, and 42 per cent in 1931. The total value of brass and bronze manufactures exported in 1931 decreased 52 per cent.

Domestic brass and bronze manufactures exported from the United States, 1927–1931

[Zinc content approximately 30 per cent by weight]

Year	Bars, plates, and sheets		Scrap and old [1]		Articles made from brass (value)	Total value
	Short tons	Value	Short tons	Value		
1927	1, 756	$648, 853	45, 997	$8, 824, 029	$8, 043, 131	$17, 516, 013
1928	2, 202	905, 430	42, 413	7, 947, 218	8, 765, 231	17, 617, 879
1929	2, 935	1, 330, 119	[2] 27, 746	[2] 6, 167, 038	10, 005, 920	17, 503, 077
1930	2, 284	964, 508	[2] 23, 617	[2] 4, 423, 151	7, 608, 728	12, 996, 387
1931	1, 363	419, 688	[2] 12, 177	[2] 1, 624, 868	4, 248, 686	6, 293, 242

[1] 1927 and 1928 classification reads "Ingots, scrap, and old."

[2] Figures include ingots, as follows: 1929, 879 tons, valued at $267,639; 1930, 2,004 tons, $266,050; 1931, 585 tons, $105,482.

CONSUMPTION

APPARENT DELIVERIES OF PRIMARY SLAB ZINC TO DOMESTIC CONSUMERS

Primary slab zinc available for consumption in the United States, 1927–1931, in short tons

	1927	1928	1929	1930	1931
Supply:					
Stock Jan. 1—					
At smelters	26, 937	53, 522	48, 432	85, 904	167, 293
Production	592, 516	602, 581	625, 447	498, 045	291, 996
Imports, foreign	59	3	226	346	294
Imports, domestic, returned	----------	----------	----------	----------	3
Total available	619, 512	656, 106	674, 105	584, 295	459, 586
Withdrawn:					
Exports, foreign, from warehouse	(1)	(1)	(1)	(1)	(1)
Exports, foreign, under drawback	----------	----------	----------	32	----------
Exports, domestic	[1] 49, 617	[1] 29, 614	[1] 19, 676	[1] 8, 501	[1] 3, 402
Stock Dec. 31—					
At smelters	53, 522	48, 432	85, 904	167, 293	143, 592
Total withdrawn	103, 139	78, 046	105, 580	175, 826	146, 994
Available for consumption	516, 373	578, 060	568, 525	408, 469	312, 592

[1] Foreign exports included under domestic exports.

In the foregoing table an attempt has been made to include only primary slab zinc or zinc produced from ores. Each year primary smelters produce a substantial tonnage of redistilled secondary zinc, most of which is inseparable from primary metal; therefore, smelter stocks at the end of the year and exports of domestic zinc probably contain some secondary metal. Although the amount is relatively small the slight inconsistency in the table should be noted. More precise segregation of figures for primary and secondary metal is virtually impossible. As the table does not consider the fluctuation in consumers' stocks, only the general trend of consumption of primary zinc is indicated.

The supply of new zinc available for consumption in 1931 was 23 per cent less than in 1930, 46 per cent less than in the record year 1928, and below that in each year since 1921.

CONSUMPTION BY USES

Zinc ore may be used for the manufacture of slab zinc, zinc dust, pigments, and salts. This chapter is concerned chiefly with slab zinc, and the discussion that follows is confined to the uses of that product.

Besides primary slab zinc a large quantity of secondary zinc was recovered in the form of slab zinc, brass and other alloys, pigments, salts, and zinc dust. These items have been discussed briefly in a previous section (p. 271) of this chapter and in more detail in the Mineral Resources chapter on Secondary Metals. The secondary zinc recovered in 1931 in the form of slab zinc and brass and other alloys totaled 72,200 tons. The lack of data on stocks makes it impossible to state how much of this metal was actually consumed in 1931. It should be noted, however, that the quantity of secondary zinc recovered as slab zinc and in alloys during the past five years has averaged 25 per cent of the supply of new zinc available for consumption.

The three chief uses of slab zinc are in the manufacture of zinc-coated (galvanized) products, brass, and sheet zinc. Other minor uses are in the manufacture of French oxide, atomized zinc dust, die castings, and slush castings and for the desilverization of lead. The following table, giving the estimated industrial use of zinc in the United States from 1927 to 1931, has been taken from the Year Book of the American Bureau of Metal Statistics, 1931.

Estimated industrial use of zinc in the United States, 1927–1931, in short tons [1]

Purpose	1927	1928	1929	1930	1931
Galvanizing:					
Sheets	138,500	144,100	142,800	103,900	77,100
Tubes	54,000	54,200	52,200	38,800	28,300
Wire	38,500	41,300	39,000	25,100	21,600
Wire cloth	6,500	8,400	10,800	9,400	6,900
Shapes [2]	42,500	43,000	45,200	39,800	34,100
	280,000	291,000	290,000	217,000	168,000
Brass and casting [3]	160,000	174,000	185,000	120,000	98,000
Rolled zinc	74,100	73,500	68,300	51,400	58,300
Die castings	18,000	30,000	36,000	21,500	20,000
Other purposes [4]	51,000	58,000	55,000	41,000	34,700
	583,100	626,500	634,300	450,900	379,000

[1] Year Book, American Bureau of Metal Statistics, 1931, p. 73.

[2] Includes pole-line hardware, hollow ware, chains, and all articles not elsewhere mentioned. The estimates for the use of slab zinc under this head, and also for wire cloth, are probably incomplete.

[3] Includes all casting other than die casting, slush casting, and battery zinc.

[4] Includes slab zinc used for manufacture of French oxide, lithopone, atomized zinc dust, wire, zinc for wet batteries, slush castings, and for the desilverization of lead.

The foregoing table is based upon reports from consumers and includes both primary and secondary slab zinc. The Bureau of Mines estimate of primary zinc available for consumption is based upon reports from producers; if the estimated production of secondary metal is added to this it will be found that the total for the past five years fails to equal the estimated industrial use of zinc, as reported by the American Bureau of Metal Statistics, by only 4,781 tons (about 0.2 per cent of the total zinc consumed).

The estimated industrial use of zinc in 1931 decreased 16 per cent and was the lowest since 1921. Consumption of copper decreased 32 per cent and that of lead 26 per cent. Basic factors contributing to the decreased use of zinc included decreases of 30 per cent in the number of automobiles and trucks manufactured and 55 per cent in the industrial building contracts awarded.

The galvanizing industry is the largest consumer of slab zinc and has accounted for 47 per cent of the total zinc used in the United States during the past five years. In 1931 the zinc consumed in this industry was 44 per cent of the total and 23 per cent less than in 1930.

Brass making ranks second in use of slab zinc, consuming 28 per cent of the total during the past five years; however, it is of interest that the use of zinc in brass has not kept pace with the general increase in consumption during the past decade. In 1922 about 33 per cent of the total slab zinc consumed was used in brass and in 1931 only 26 per cent. Brass exports are classified as bars, plates, and sheets, as scrap and old, and as articles made from brass; all decreased 40 per cent or more in 1931. The total value of brass exports decreased 52 per cent.

The use of zinc in the manufacture of rolled-zinc products increased 13.4 per cent in 1931 compared with 1930, ending a decline which began in 1927, but the quantity produced was 32 per cent less than in 1926, the record year.

Another important and promising use of zinc is as the essential constituent of die-casting alloys. From 1926 to 1929 this use of zinc increased 167 per cent but in 1930 decreased 40 per cent, amounting to 21,500 tons (5 per cent of the total zinc consumption). There was a further decrease of 7 per cent in 1931, but the quantity consumed still accounted for 5 per cent of the total consumption.

Other miscellaneous uses accounted for 34,700 tons of zinc (9 per cent of the total) in 1931. Approximately 75 per cent of this item is chargeable to the 26,000 tons of slab zinc used in the manufacture of French-process zinc oxide, as reported by the Bureau of Mines. Under normal conditions about 5,000 tons of zinc are used annually in the Parkes process for desilverizing lead. Some slab zinc was used in the manufacture of "atomized" zinc dust in 1931.

PRICES

The decline in the price of zinc which persisted throughout 1930 was temporarily halted during the first three months of 1931, when quotations were maintained fairly well near 4 cents per pound (prime western at St. Louis, for immediate delivery). Meanwhile, the London price had continued to decline, and in April domestic deliveries fell off causing a sharp rise in stocks. These factors precipitated a decline in quotations which continued until the debt moratorium was announced in June. Prices then rose to an average of 3.90 cents in July, but thereafter the trend was steadily downward for the rest of the year. This trend reflected the weakness of the European market, as the domestic industry during the last six months of the year was characterized by stability of stocks, production, and consumption.

The average St. Louis quotation for the year was 3.64 cents and the New York average 3.99 cents, the latter being the lowest since 1896. The St. Louis quotation on January 2, 1931, was 4.12½ cents and on December 31, 1931, 3.12½. The drop from an average of 4.03 cents for January to 3.15 cents in December represented a decrease of 22 per cent. During the same period the London quotation for spot zinc declined 22 per cent also, from 2.76 to 2.16 cents. The average London price for 1931 was 2.52 cents compared with 3.60 cents in 1930 and was the lowest yearly average on record. A differential between the London and St. Louis prices of about 1 cent a pound was maintained throughout the year, the average being 1.12 cents per pound in favor of St. Louis compared with 0.96 cent in 1930 and 1.09 cents in 1929.

The following table shows monthly fluctuations in price of prime western zinc at St. Louis from 1927 to 1931 and at London during 1931.

Average monthly quoted price of zinc at St. Louis, 1927–1931, and at London, 1931, in cents per pound [1]

Month	St. Louis (for immediate delivery)					London,[2] 1931
	1927	1928	1929	1930	1931	
January	6.68	5.65	6.34	5.24	4.03	2.76
February	6.69	5.55	6.34	5.17	4.02	2.78
March	6.71	5.63	6.45	4.94	4.01	2.64
April	6.35	5.76	6.63	4.84	3.69	2.46
May	6.08	6.04	6.56	4.65	3.31	2.28
June	6.23	6.16	6.64	4.45	3.40	2.56
July	6.24	6.20	6.74	4.33	3.90	2.66
August	6.36	6.25	6.78	4.36	3.82	2.48
September	6.22	6.25	6.78	4.27	3.74	2.34
October	6.00	6.25	6.72	4.06	3.38	2.21
November	5.75	6.27	6.22	4.28	3.20	2.30
December	5.73	6.35	5.65	4.09	3.15	2.16
High monthly average	6.71	6.35	6.78	5.24	4.03	2.78
Low monthly average	5.73	5.55	5.65	4.06	3.15	2.16
Average for year	6.25	6.03	6.49	4.56	3.64	2.52

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[1] Metal Statistics, 1932, pp. 401 and 409.

[2] Conversion of English quotations into American money based on average monthly rate of exchange, as recorded by the Federal Reserve Board of the Treasury.

New York quoted prices are slightly above St. Louis prices, owing to the freight rate of 0.35 cent per pound between the two cities.

According to reports submitted to the Bureau of Mines the stocks of slab zinc at smelters decreased from 167,293 tons on January 1 to 143,592 tons on December 31, 1931.

The average weekly quoted prices for 60 per cent zinc concentrates in the Joplin market and the St. Louis quotations for prime western and brass special grades of slab zinc during 1931 are shown in the following table.

Average weekly quoted prices of 60 per cent zinc concentrates at Joplin, Mo., and of zinc of "prime western" and "brass special" grades at St. Louis in 1931

Week ended—	60 per cent zinc concentrates in the Joplin region (dollars per ton) [1]	Prime western zinc in St. Louis (cents per pound) [2]	Brass special zinc in St. Louis (cents per pound) [2]	Week ended—	60 per cent zinc concentrates in the Joplin region (dollars per ton) [1]	Prime western zinc in St. Louis (cents per pound) [2]	Brass special zinc in St. Louis (cents per pound) [2]
Jan. 3	26.00	4.12½	4.22½	July 4	23.00	3.92½	4.02½
Jan. 10	26.00	4.06	4.16	July 11	23.00	3.89½	3.99½
Jan. 17	26.00	4.01	4.11	July 18	23.00	3.90	4.00
Jan. 24	26.00	4.00	4.10	July 25	23.00	3.89	3.99
Jan. 31	27.00	4.04½	4.14½	Aug. 1	23.00	3.86½	3.96½
Feb. 7	27.00	4.08½	4.18½	Aug. 8	23.00	3.85	3.95
Feb. 14	26.00	4.01⅞	4.11⅞	Aug. 15	23.00	3.82½	3.92½
Feb. 21	25.00	3.97½	4.07½	Aug. 22	(3)	3.80	3.90
Feb. 28	25.00	3.98¾	4.08¾	Aug. 29	23.00	3.80	3.90
Mar. 7	25.00	4.05	4.15	Sept. 5	23.00	3.80	3.90
Mar. 14	25.00	4.03	4.13	Sept. 12	23.00	3.79 11/16	3.89 11/16
Mar. 21	25.00	4.00	4.10	Sept. 19	23.00	3.75½	3.85½
Mar. 28	25.00	3.98½	4.08½	Sept. 26	23.00	3.70	3.80
Apr. 4	25.00	3.95	4.05	Oct. 3	22.00	3.63	3.73
Apr. 11	24.00	3.90¼	4.00¼	Oct. 10	20.00	3.54½	3.64½
Apr. 18	22.00	3.75½	3.85½	Oct. 17	19.00	3.40	3.50
Apr. 25	20.00	3.55¼	3.65¼	Oct. 24	18.00	3.30	3.40
May 2	20.00	3.37½	3.42½	Oct. 31	18.00	3.20¼	3.30¼
May 9	20.00	3.27	3.32	Nov. 7	18.00	3.15 15/16	3.25 15/16
May 16	20.00	3.33¾	3.38¾	Nov. 14	19.00	3.25¾	3.35¾
May 23	20.00	3.34½	3.39½	Nov. 21	18.00	3.25½	3.35½
May 30	21.00	3.28	3.33	Nov. 28	18.50	3.14⅜	3.24⅜
June 6	21.00	3.22	3.27	Dec. 5	19.00	3.13	3.23
June 13	21.00	3.29½	3.37½	Dec. 12	19.00	3.17	3.27
June 20	21.00	3.37	3.47	Dec. 19	18.00	3.15	3.25
June 27	22.00	3.53½	3.63½	Dec. 26	18.00	3.15	3.25

[1] Joplin Globe, Dec. 26, 1931, p. 16.
[2] American Metal Market, daily.
[3] Not given.

The preceding table shows that the price of concentrates followed the price of slab zinc very closely but did not reflect the smaller fluctuations in metal price. The average price realized on all shipments during 1931, as reported by the American Metal Market, was $22.69 per ton, equivalent to 1.9 cents per pound of zinc content. As the average price of slab zinc was 3.6 cents the difference of 1.7 cents per pound covers the cost of smelting and marketing, smelting profits, and metallurgical losses. In 1930 the mines realized 2.7 cents per pound of zinc contained in the concentrates as compared with an average price of 4.6 cents per pound for slab zinc.

The following table shows the actual prices received by producers for various grades of zinc, based upon the total value received as reported by them.

Average price of zinc, 1927–1931, by grades, in cents per pound

	1927	1928	1929	1930	1931
Grade A (high grade)	6.67	6.18	6.80	4.92	4.00
Grade B (intermediate)					
Grades C and D (select and brass special)	6.24	5.99	6.44	4.71	3.63
Grade E (prime western)	6.31	6.08	6.42	4.69	3.73
All grades	6.4	6.1	6.6	4.8	3.8
Prime western; average spot quotation at St. Louis	6.3	6.0	6.5	4.6	3.6

The American Metal Market reported the following average quoted prices (cents per pound) for 1930 and 1931.

	1930	1931
High-grade zinc (delivered at eastern points)	5. 58	4. 63
Brass special (f. o. b. East St. Louis)	4. 64	3. 73
Prime western (f. o. b. St. Louis)	4. 56	3. 64
Prime western (f. o. b. New York)	4. 91	3. 99

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEW MEXICO[1] [2]

(MINE REPORT)

By C. W. Henderson

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SUMMARY

The total calculated gross value of the recoverable gold, silver, copper, lead, and zinc from lode and placer mines in New Mexico in 1931 amounted to $9,494,766 compared with $13,748,217 in 1930—a decrease of 31 per cent. There were 168 producing mines in 1931, comprising 59 lode mines and 109 placers, a decrease of 29 lode mines but an increase of 104 placers from 1930.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064
1928	.585	.144	.058	.061
1929	.533	.176	.063	.066
1930	$0.385	$0.130	$0.050	$0.048
1931	.290	.091	.037	.038

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[1] Work on manuscript completed August, 1932.

[2] Published data on the metal resources of New Mexico are scanty. The mine report series of Mineral Resources, of which this chapter forms a part, have been published annually since 1904. Annual reports of the Director of the Mint begin with the year 1880. Professional Paper 68 of the U. S. Geological Survey, published in 1910, is a most valuable reference book covering the whole State. The Report of the Appraisal of Mining Properties of New Mexico, by J. R. Finlay, for the State Tax Commission, Santa Fe, 1921–22, contains valuable notes. Additional references are given in the section of this chapter, "Review by counties and districts," pp. 303 to 313.

Mine production of gold, silver, copper, lead, and zinc in New Mexico, 1927–1931, in terms of recovered metals

Year	Mines producing			Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Total		Fine ounces	Value	Fine ounces	Value
1927	102	10	112	3, 442, 184	29, 241. 87	$604, 483	890, 083	$504, 677
1928	93	6	99	4, 073, 974	32, 912. 41	680, 360	827, 793	484, 259
1929	113	8	121	4, 506, 807	35, 176. 46	727, 162	1, 121, 546	597, 784
1930	88	5	93	2, 971, 441	32, 370. 42	669, 156	1, 107, 335	426, 324
1931	59	109	168	3, 003, 941	31, 161. 24	644, 160	1, 041, 859	302, 139

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1927	74, 251, 863	$9, 726, 994	16, 052, 855	$1, 011, 330	59, 603, 000	$3, 814, 592	$15, 662, 076
1928	89, 854, 646	12, 939, 069	15, 610, 501	905, 409	62, 406, 000	3, 806, 766	18, 815, 863
1929	97, 717, 262	17, 198, 238	22, 260, 811	1, 402, 431	68, 910, 000	4, 548, 060	24, 473, 675
1930	65, 150, 000	8, 469, 500	20, 756, 900	1, 037, 845	65, 529, 000	3, 145, 392	13, 748, 217
1931	61, 503, 100	5, 596, 782	22, 537, 000	833, 869	55, 732, 000	2, 117, 816	9, 494, 766

Gold and silver produced at placer mines in New Mexico, 1927–1931

Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value	
1927	280. 97	$5, 808	32	$18	$5, 826
1928	65. 16	1, 347	17	10	1, 357
1929	79. 82	1, 650	4	2	1, 652
1930	63. 66	$1, 316	18	$7	$1, 323
1931	406. 59	8, 405	59	17	8, 422

GOLD

The mine production of recoverable gold in New Mexico in 1931 was valued at $644,160 compared with $669,156 in 1930. San Miguel County produced 47.94 per cent of the total in 1931, Hidalgo 36.22 per cent, Grant 11.74 per cent, and Catron 2.32 per cent. Lead-zinc ore yielded 48.31 per cent of the total gold, dry and siliceous ore 36.46 per cent, and copper ore 13.68 per cent. Placer mines yielded 1.30 per cent.

SILVER

The mine production of recoverable silver in New Mexico in 1931 amounted to 1,041,859 fine ounces, valued at $302,139, compared with 1,107,335 fine ounces, valued at $426,324, in 1930. Grant County produced 41.98 per cent of the total in 1931, chiefly from the Central district; San Miguel County 40.35 per cent, all from the lead-zinc ore from the Pecos mine in the Willow Creek district; Hidalgo County 13.33 per cent, chiefly from the Lordsburg district; Catron County 3.72 per cent, from the Mogollon district; and Sierra County 0.43 per cent, chiefly from the Chloride district.

Lead-zinc ore from Grant and San Miguel Counties yielded 71.94 per cent of the total silver; dry and siliceous ore, chiefly from Catron and Hidalgo Counties, 15.19 per cent; copper ore, chiefly from Grant and Hidalgo Counties, 8.95 per cent; copper-lead ore, chiefly from

Grant County, 3.62 per cent; and lead ore, chiefly from Grant, Hidalgo, and Lincoln Counties, 0.29 per cent.

COPPER

The mine production of recoverable copper in New Mexico in 1931 amounted to 61,503,100 pounds, valued at $5,596,782, compared with 65,150,000 pounds, valued at $8,469,500, in 1930. Grant and Hidalgo Counties produced 98.08 per cent of the total in 1931, chiefly from the operations of the Santa Rita mines in the Central district, Grant County, and from the Eighty-Five mine in the Lordsburg district, Hidalgo County. San Miguel County, third in order of output, yielded 1.78 per cent from the lead-zinc ore of the Pecos mine. Copper ore yielded 87.50 per cent and lead-zinc ore 6.15 per cent of the total copper.

LEAD

The mine production of recoverable lead in New Mexico in 1931 amounted to 22,537,000 pounds, valued at $833,869, compared with 20,756,900 pounds, valued at $1,037,845, in 1930. The chief lead-producing districts were the Willow Creek, San Miguel County; the Central, Grant County; the High Rolls, Otero County; and the Gillespie and Lordsburg districts, Hidalgo County. Lead-zinc ore yielded 91.95 per cent, copper-lead ore 4.22 per cent, and lead ore 2.74 per cent of the total lead.

ZINC

The mine production of recoverable zinc in New Mexico in 1931 amounted to 55,732,000 pounds, valued at $2,117,816, compared with 65,529,000 pounds, valued at $3,145,392, in 1930. The zinc-producing districts in 1931 were the Willow Creek in San Miguel County and the Central in Grant County.

Zinc concentrates produced in 1931 amounted to 60,176 tons, containing, as shipped, 1,673.16 ounces of gold, 179,957 ounces of silver, 1,260,834 pounds of copper, 2,072,155 pounds of lead, and 65,973,250 pounds of zinc. The average zinc content was therefore 54.82 per cent.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1931, by counties, in terms of recovered metals

County	Mines producing			Ore (short tons)	Gold (lode and placer)	Silver (lode and placer)	
	Lode	Placer	Total			Fine ounces	Value
Catron	1	--------	1	6, 274	$14, 967	38, 800	$11, 252
Colfax	--------	5	5	------------	829	7	2
Dona Ana	5	--------	5	462	475	576	167
Grant	18	71	89	2, 714, 696	75, 651	437, 400	126, 846
Hidalgo	8	--------	8	96, 316	233, 340	138, 893	40, 279
Lincoln	2	4	6	3	898	783	227
Otero	4	--------	4	1, 047	100	152	44
San Miguel	1	--------	1	184, 502	308, 831	420, 386	121, 912
Santa Fe	--------	22	22	------------	2, 207	7	2
Sierra	17	7	24	578	6, 673	4, 500	1, 305
Socorro	2	--------	2	38	------------	62	18
Taos	1	--------	1	25	189	293	85
	59	109	168	3, 003, 941	644, 160	1, 041, 859	302, 139
Total, 1930	88	5	93	2, 971, 441	669, 156	1, 107, 335	426, 324

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1931, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Catron	1, 100	$100	----------	----------	----------	----------	$26, 319
Colfax	----------	----------	----------	----------	----------	----------	831
Dona Ana	40, 000	3, 640	20, 000	$740	----------	----------	5, 022
Grant	56, 328, 000	5, 125, 848	6, 848, 000	253, 376	14, 099, 000	$535, 762	6, 117, 483
Hidalgo	3, 991, 900	363, 263	204, 000	7, 548	----------	----------	644, 430
Lincoln	100	9	300	11	----------	----------	1, 145
Otero	5, 000	455	307, 000	11, 359	----------	----------	11, 958
San Miguel	1, 096, 000	99, 736	15, 125, 000	559, 625	41, 633, 000	1, 582, 054	2, 672, 158
Santa Fe	----------	----------	----------	----------	----------	----------	2, 209
Sierra	21, 000	1, 911	24, 000	888	----------	----------	10, 777
Socorro	20, 000	1, 820	8, 700	322	----------	----------	2, 160
Taos	----------	----------	----------	----------	----------	----------	274
	61, 503, 100	5, 596, 782	22, 537, 000	833, 869	55. 732, 000	2, 117, 816	9, 494, 766
Total, 1930	65, 150, 000	8, 469, 500	20, 756, 900	1, 037, 845	65, 529, 000	3, 145, 392	13, 748, 217

MINING INDUSTRY

The outstanding features of the mining industry in New Mexico in 1931 were the increase in output of placer gold from $1,316 in 1930 to $8,405 in 1931 and the small decrease in output of lode gold from $667,840 to $635,755; the small decrease in output of silver from 1,107,335 to 1,041,859 ounces; the decrease in production of copper from 65,150,000 to 61,503,100 pounds; the increase in production of lead from 20,756,900 to 22,537,000 pounds; and the decrease in output of zinc from 65,529,000 pounds in 1930 to 55,732,000 pounds in 1931.

The near maintenance of copper production was based on the slight reduction only in operations of Chino Mines at Santa Rita, Grant County, and of the Lordsburg district, Hidalgo County (principally the Eighty-Five mine). The relatively small decrease in zinc production and the increase in lead may be attributed to the increased output in 1931 of lead and zinc concentrates from the Pecos mine, San Miguel County, whose steady operation also maintained the gold and silver production of the State. The decrease in the total zinc production of the State may be attributed also to the fact that the Empire Zinc Co. mill at Hanover operated only 3 months and the Peru mill at Deming only 66 days. The Black Hawk (or Combination) zinc-lead-copper mill at Hanover ran throughout the year. The complete idleness in 1931 in the Magdalena district, Socorro County, also contributed to the decrease in zinc output.

Minor operations affected the results only slightly, but for the second year two attempts to use flotation instead of cyanidation at Mogollon, Catron County, helped to maintain the State's gold and silver production. The idleness of the small copper mine at Pastura reduced the State copper output by 951,000 pounds.

Details of the foregoing and of other operations will be found under the section " Review by Counties and Districts," page 303.

ORE CLASSIFICATION

Ore sold or treated in New Mexico in 1931, with content in terms of recovered metals

Source	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	727	321.68	761	3,350	500	
Dry gold and silver ore	96,577	11,036.68	155,585	3,660,100	96,200	
Dry silver ore	198	2.48	1,911	2,500	3,600	
	97,502	11,360.84	158,257	3,665,950	100,300	
Copper ore	2,642,654	4,262.06	93,271	53,816,742	96,100	
Copper-lead ore	3,347	9.30	37,709	233,208	951,441	
Lead ore	1,982	69.75	3,072	5,200	617,159	
Lead-zinc ore	225,581	15,052.70	749,491	3,782,000	20,722,000	49,603,000
Zinc ore	32,875				50,000	6,129,000
	2,906,439	19,393.81	883,543	57,837,150	22,436,700	55,732,000
Total, lode mines	3,003,941	30,754.65	1,041,800	61,503,100	22,537,000	55,732,000
Total, placers		406.59	59			
	3,003,941	31,161.24	1,041,859	61,503,100	22,537,000	55,732,000
Total, 1930	2,971,441	32,370.42	1,107,335	65,150,000	20,756,900	65,529,000

METALLURGIC INDUSTRY

All markets for New Mexico ore and concentrates are outside the borders of the State. In 1931 lead ores and concentrates were sold to the American Smelting & Refining Co. lead plant at El Paso, Tex., and to the Copper Queen lead plant at Douglas, Ariz. Copper ore and concentrates were sold to the American Smelting & Refining Co. copper plant at El Paso, to the Copper Queen copper smelter at Douglas, and to the Calumet and Arizona copper plant at Douglas. Zinc ore and concentrates were shipped to the United States Zinc Co. natural-gas retort plant at Amarillo, Tex.; to the Illinois Zinc Co. retort plant at Peru, Ill.; to the National Zinc Co. natural-gas retort plant at Bartlesville, Okla.; to the American Metal Co. producer-gas retort plant at Langeloth, Pa.; and to the Empire Zinc Co. zinc oxide plant at Canon City, Colo. Iron ore went to Pueblo, Colo.

By the end of 1931 all the important mills were using the selective flotation method. The following table gives the names of the flotation mills in New Mexico active in 1931 and the location, county, rated capacity, type of ore treated, and type of concentrates produced.

Flotation mills in New Mexico active in 1931

Name of company or mill	Location of mill	County	Rated capacity (short tons per 24 hours)	Type of ore treated	Type of concentrate produced
Chino Mines	Hurley	Grant	15,000	Copper	Copper.
Combination (Black Hawk).	Hanover	do	175	Zinc-lead-copper	Zinc, lead-copper.
Empire Zinc Co	do	do	300	Zinc	Zinc.
Little Fanney	Mogollon	Catron	50 to 70	Gold and silver	Gold and silver.
Molybdenum Corporation of America.	Red River and Sulphur Creek.	Taos	40	Molybdenum	Molybdenum.
Pecos (American Metal Co.)	Alamitos Canyon	San Miguel	600	Zinc-lead-copper	Zinc, lead-copper.
Peru Mining Co	Wemple	Luna	300	Zinc	Zinc.

Mine production of metals in New Mexico in 1931, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amalgamation	3	38. 63	9	------------	------------	------------
Concentrates smelted	[1] 175, 001	19, 126. 73	839, 567	56, 364, 100	20, 772, 000	55, 732, 000
Ore smelted	119, 028	11, 589. 29	202, 224	5, 139, 000	1, 765, 000	------------
Placer	------------	406. 59	59	------------	------------	------------
	------------	31, 161. 24	1, 041, 859	61, 503, 100	22, 537, 000	55, 732, 000
Total, 1930	------------	32, 370. 42	1, 107, 335	65, 150, 000	20, 756, 900	65, 529, 000

[1] From 2,884,910 tons of ore concentrated.

Gross metal content of New Mexico concentrates produced in 1931, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold and silver	101	724. 03	38, 800	1, 175	------------	------------
Copper	85, 915	3, 350. 00	51, 276	54, 771, 459	------------	------------
Copper-lead	9, 898	96. 70	303, 393	3, 351, 106	5, 737, 074	2, 019, 192
Lead	18, 911	14, 939. 69	420, 391	1, 565, 830	15, 125, 017	5, 000, 068
Zinc	60, 176	1, 673. 16	179, 957	1, 260, 834	2, 072, 155	65, 973, 250
	175, 001	20, 783. 58	993, 817	60, 950, 404	22, 934, 246	72, 992, 510
Total, 1930	189, 367	18, 139. 34	895, 688	61, 904, 218	21, 946, 768	83, 796, 784

Mine production of metals from concentrating mills in New Mexico in 1931, by counties, in terms of recovered metals

County	Ore treated	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Catron	6, 274	101	724. 03	38, 800	1, 100	------------	------------
Grant	2, 694, 134	111, 209	3, 463. 00	380, 381	55, 267, 000	5, 647, 000	14, 099, 000
San Miguel	184, 502	63, 691	14, 939. 70	420, 386	1, 096, 000	15, 125, 000	41, 633, 000
	2, 884, 910	175, 001	19, 126. 73	839, 567	56, 364, 100	20, 772, 000	55, 732, 000
Total, 1930	2, 830, 965	189, 367	17, 673. 16	871, 402	58, 122, 400	18, 514, 000	64, 059, 000

Gross metal content of New Mexico crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	724	305. 72	755	4, 000	1, 036	------------
Dry gold and silver	90, 303	10, 312. 65	116, 785	4, 377, 986	185, 160	------------
Dry silver	198	2. 50	1, 911	2, 667	7, 172	------------
Copper	22, 474	912. 10	41, 998	1, 288, 914	192, 295	275, 000
Copper-lead	3, 347	9. 30	37, 711	333, 568	1, 056, 463	323, 700
Lead	1, 982	47. 11	3, 073	7, 819	685, 324	------------
	119, 028	11, 589. 38	202, 233	6, 014, 954	2, 127, 450	598, 700
Total, 1930	140, 376	14, 598. 44	236, 520	7, 971, 667	2, 750, 364	1, 838, 570

Mine production of metals from New Mexico crude ore shipped to smelters in 1931, by counties, in terms of recovered metals

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dona Ana	462	22.98	576	40,000	20,000	
Grant	20,559	63.10	56,984	1,061,000	1,201,000	
Hidalgo	96,316	11,287.82	138,893	3,991,900	204,000	
Lincoln	3	.50	773	100	300	
Otero	1,047		151	5,000	307,000	
Sierra	578	205.75	4,492	21,000	24,000	
Socorro	38		62	20,000	8,700	
Taos	25	9.14	293			
	119,028	11,589.29	202,224	5,139,000	1,765,000	
Total, 1930	140,376	14,598.44	235,673	7,027,600	2,242,900	1,470,000

REVIEW BY COUNTIES AND DISTRICTS

CATRON COUNTY

Mogollon district.[3]—A brief history of mining in the Mogollon district appears in the 1929 report of this series. The Lehigh Metals Co., which experimented in 1929 and 1930 in the use of flotation on ores from this district formerly cyanided, operated the remodeled Little Fanney mill from January 1 to May 5, 1931; on October 15 it was turned over to the Wright Leasing Co., which continued operation into 1932. Ore was extracted in 1931 from the Little Fanney, Champion, and Johnson claims.

COLFAX COUNTY

Mount Baldy district (*Baldy*, *Elizabethtown*, *Therma*).—A brief history of mining in the Mount Baldy district is given in the 1929 report of this series. In 1931 at the Aztec[4] lode mine driving the adit from Ponil Creek was continued 385 feet during the first half of the year; no ore was encountered, and work was discontinued. Small sluicing operations in the district yielded 40.10 fine ounces of gold and 7 ounces of silver. The principal producing placer was the Dickey on Willow Creek, operated by lessees from June to November; production was 26.76 crude ounces of placer bullion, which after melting at the Denver Mint weighed 25.48 ounces and averaged 0.862 fine in gold and 0.114 fine in silver.

DONA ANA COUNTY

Organ district.—In 1931 production from Dona Ana County was confined chiefly to shipments to the El Paso smelter of dump material from various properties near Organ. The Ashcraft Mining Co. shipped several cars of copper and copper-lead ore from the lower end of the Organ Mountains.

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[3] Scott, D. B., Ore Deposits of the Mogollon District: Trans. Am. Inst. Min. and Met. Eng., vol. 53, 1920, pp. 289–310.

Kidder, S. J., Mining Methods in Mogollon District, N. Mex.: Trans. Am. Inst. Min. and Met. Eng., vol. 72, 1925, pp. 529–549.

Ferguson, H. G., Geology and Ore Deposits of the Mogollon Mining District, N. Mex.: U. S. Geol. Survey Bull. 787, 1927, 100 pp.

[4] Chase, C. A., and Muir, Douglas, The Aztec Mine, Baldy, N. Mex.: Trans. Am. Inst. Min. and Met. Eng., vol. 68, 1923, pp. 270–281. *See also* Finlay, J. R., Report of Appraisal of Mining Properties of New Mexico, Santa Fe, State Tax Commission, 1921–22; Lee, W. T., The Aztec Gold Mine, Baldy, N. Mex.; Contributions to Economic Geology, 1915, Part I: U. S. Geol. Survey Bull. 620, 1916, pp. 325–330.

GRANT COUNTY[5]

Burro Mountain district (*Tyrone*).[6]—In 1931 the only shipment from the Burro Mountain district was 43 tons of copper ore by L. Worcester. There were no operations by lessees or the corporation on the properties of the Burro Mountain branch (Tyrone) of the Phelps Dodge Corporation.

Central district (*Bayard*, *Fierro*, *Georgetown*, *Hanover*, *Santa Rita*).—The Central district in 1931 continued to hold its place as the principal producing district in New Mexico. Production was 2,714,360 tons of ore containing, in terms of recovered metals, 3,517.25 ounces of gold, 435,338 ounces of silver, 56,317,175 pounds of copper, 6,840,600 pounds of lead, and 14,099,000 pounds of zinc. In addition, iron ore was shipped from the district to the steel mill at Pueblo, Colo.

The Black Hawk Consolidated Mines Co. concentrator[7] at Hanover continued operations in 1931 only as a custom mill for the treatment of zinc-lead-copper-silver sulphide ore from the Ground Hog and San Jose properties of the Asarco Mining Co. near Cobre. The mill feed averaged 8.73 ounces of silver, 4.79 per cent copper (wet assay), 8.78 per cent lead (wet assay), and 15.88 per cent zinc. The mill was operated at a daily average of 160 tons in 1931. The equipment of this selective flotation mill, as originally completed in August, 1928, was described in the 1929 report of this series, and the additional equipment installed in 1930 was described in the 1930 report of this series. The Black Hawk Consolidated Mines Co. shipped lead-silver ore from its Lucky Bill mine to the El Paso smelter. The Asarco Mining Co. (Ground Hog unit) shipped copper-[zinc]-silver ore and lead-copper-[zinc]-silver ore during 1931 from the Ground Hog and the adjoining San Jose mine to the El Paso smelter.

The Empire Zinc Co. 300-ton flotation mill at Hanover was operated from January to April 1 on zinc sulphide ore from its Hanover mine. The zinc concentrates produced were shipped to the company plant at Canon City, Colo. In addition, a considerable tonnage of iron ore was shipped from the Hanover mine to the steel plant of the Colorado Fuel & Iron Co. at Pueblo, Colo.

The Hanover Bessemer Iron & Copper Co. and lessees shipped from Fierro[8] one car of gold ore. The company also operated its magnetic separator plant on its magnetite ore, shipping the beneficiated product to the Colorado Fuel & Iron Co. at Pueblo.

The Nevada Consolidated Copper Co., Chino Mines division, operated its 15,000-ton flotation mill at Hurley for 296 days at an average daily rate of 8,852 tons—the total ore treated being 2,620,180 dry tons, equivalent to a daily average of 7,178 tons for 365 days. The ore is mined from open pits by steam and electric shovels. During the year one additional steam shovel was converted to electric, making a total of nine electric shovels available. The ore bodies occur in highly altered porphyry and sediments under an overburden whose thickness ranges from nothing to 150 feet. The ore itself has a maximum thickness of 600 feet and is about 300 feet thick near the pit margins.[9] No new construction and no exploratory work, either underground or surface drilling, were done. The mine was operated 26 days a month for the first half of 1931 and 23 days for the remainder of the year. Iron oxide ore was shipped during the year to the steel plant of the Colorado Fuel & Iron Co. at Pueblo. As was noted in the 1930 report of this series, the additional tonnage susceptible to power-shovel mining (disclosed by the 1929–1930 drilling campaign begun in August, 1929) resulted in practically doubling that class of reserve and has rendered unnecessary any further preparation for underground mining.

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[5] For a description of the geology of Bear Mountain, Burro Mountain, Chloride Flat, Fierro, Fleming, Georgetown, Hanover, Lone Mountain, Pinos Altos, and Santa Rita see Paige, Sidney, U. S. Geol. Survey Geol. Atlas U. S., Silver City folio (No. 199), 1916.

[6] Paige, Sidney, Copper Deposits of the Tyrone District, N. Mex.: U. S. Geol. Survey Prof. Paper 122, 1922.

[7] See Wright, I. L., Milling Methods and Costs at the Black Hawk Concentrator, Hanover, N. Mex.: Inf. Circ. 6359, Bureau of Mines, 1930, 15 pp.

[8] Paige, Sidney, The Hanover Iron-Ore Deposits, N. Mex.; Contributions to Economic Geology, 1908, Part I: U. S. Geol. Survey Bull. 380, 1908, pp. 199–214.

The Twenty-Fifth Annual Report of the Nevada Consolidated Copper Co., for the year ended December 31, 1931, contains the following statement with respect to the operations of the Chino Mines division and the revenue and costs of the combined Nevada, Ray, and Chino divisions:

> *General operations.*—The operations of the three mines in Nevada, Arizona, and New Mexico resulted in a total production of 130,955,972 pounds of refined marketable copper, the cost of which, computed in the customary manner, including depreciation charges, was 8.68 cents per pound, comparing with a cost of 10.85 cents per pound similarly calculated for the year 1930.
>
> Reductions in output were made during the year in an effort to prevent further accumulation of unsold copper, with a corresponding depletion of cash resources. Production at the beginning of the year 1931 was at a rate below 40 per cent of the proven capacity of the properties and at the end below 30 per cent of such capacity. The continuing decrease in demand for copper metal has necessitated further reduction of output since the end of the year. It is worthy of comment in this connection that for the year 1931 the cost per pound of copper before depreciation was 8.13 cents, compared with 9.59 cents per pound for the year 1930 and, as noted in the operating officials' report, the lowest annual cost attained since the acquisition of the Ray and Chino properties. * * *
>
> Unsold copper was valued at 10.50 cents per pound at the beginning of the year and at 6.70 cents per pound at the end. Corresponding adjustments in metal inventory value were carried into current production accounts. These were responsible entirely for the stated operating loss. Reserves were set up against surplus to cover adjustments yet to be made in export copper sales accounting.
>
> Distributions made to stockholders during the year amounted to $3,885,798.40, bringing the total of dividends and distributions from inception to $148,742,228.65.
>
> *Property.*—At Chino Mines 144 acres of land at Santa Rita and 719 acres at Hurley were acquired to provide additional areas to protect water rights and for the disposal of mine waste and mill tailings. There were no acquisitions of property at either Nevada mines or Ray mines.
>
> *Improvements and developments.*—No prospect drilling or other development looking to the extension of ore bodies was undertaken at any of the three divisions except that immediately necessary in connection with mining operations.
>
> At Chino Mines there was no new construction and no exploratory work either underground or by surface drilling. The mine was operated 26 days a month for the first half and 23 days for the remainder of the year.
>
> *Operations.*—At Chino Mines the cost of power-shovel mining, exclusive of depreciation and taxes but including all other expenses, was 26.67 cents per ton.

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[9] Thorne, H. A., Mining Practice at the Chino Mines, Nevada Consolidated Copper Co., Santa Rita, N. Mex.: Inf. Circ. 6412, Bureau of Mines, 1931, 28 pp.

Hodges, Fred, Milling Methods at the Hurley Plant of the Nevada Consolidated Copper Co., Hurley, N. Mex.: Inf. Circ. 6394, Bureau of Mines, 1931, 17 pp.

The mining costs above stated do not include charges made at all mines against each ton of ore produced for prepaid development and stripping expense. This charge for the year was, at Chino Mines, 35 cents per ton of ore produced.

THE REDUCTION PLANTS

Mill construction and improvements.—At Chino Mines division operating results at the Hurley concentrator continued satisfactory in every way, and no expenditures were incurred for alterations or improvements.

Milling operations.—At Chino Mines a total of 2,620,180 dry tons of ore was milled at the Hurley concentrator during the year, equivalent to a daily average of 7,178 tons. The cost of milling, exclusive of depreciation and taxes but including all other expenses, was 35.96 cents per ton.

The total ore milled at all divisions and on all accounts for the year was 6,806,195 tons, corresponding to a daily average of 18,647 tons, as compared with 23,798 tons for the previous year.

Smelting operations.—At both Ray and Chino mines the concentrates produced from the mills and all direct smelting ores obtained from mining operations were smelted at the plants of the American Smelting & Refining Co. at Hayden, Ariz., and El Paso, Tex., respectively.

Production.—The total quantity of ore delivered from the company's Nevada, Ray, and Chino mines and treated during the year was 6,177,949 tons. Of this total, 6,144,621 tons, equivalent to a daily average of 16,835 tons, was treated at the concentrators, and 33,328 tons of crude ore was shipped direct to the smelters.

In addition to the company ores as above stated, 661,574 tons of contract and other custom ores were milled and 31,995 tons smelted at the Nevada plant.

The average grade of all company material milled was 1.263 per cent copper, and the average recovery in the form of concentrates was 86.50 per cent of the total copper contents.

The year's total net production of company copper from both concentrating and direct smelting ores was 130,955,972 pounds, as compared with a production of 141,980,173 pounds for the previous year.

General.—At Chino Mines one additional steam shovel was converted to electric during the year, making a total of nine electric shovels available, which is sufficient for the requirements of the immediate future. The milling performance at the Hurley concentrator was particularly gratifying, the milling cost for the year, exclusive of depreciation and taxes, being 35.96 cents per ton, as compared with a cost of 54.53 cents per ton for the previous year. * * *

Property and equipment are being fully maintained at all divisions, and the plants are capable of immediately moving up to full capacity production as soon as economic conditions permit. The production for the year of 130,955,972 pounds of copper was at a rate of only about 40 per cent of the output for the fourth quarter of the year 1928, which approximated a rate of 325,000,000 pounds a year and which can be readily exceeded to-day.

In spite of the low output, the net cost of producing copper for the year, exclusive of depletion and depreciation, was 8.13 cents a pound, which is the lowest cost ever made by the company since its acquisition of the Ray and Chino properties. The year was marked by a steady decrease in cost of production for each of the quarterly periods from 8.88 cents a pound in the first quarter to 7.40 cents a pound in the fourth. The lowest previous quarterly cost was 7.58 cents a pound for the fourth quarter of the year 1928 on a production of 81,226,417 pounds, whereas the decreased cost of 7.40 cents a pound for the final quarter of the year under review was reached on a production of 32,775,501 pounds. The achievement of these reduced costs at a drastically limited rate of production has been made possible through economies brought about by the improvements made in recent years, the benefits of which have not yet been fully realized because of restricted output.

Statement of operations of the Nevada Consolidated Copper Co. for the year ended December 31, 1931

Operating revenues:	
Copper produced—130,955,972 pounds at 7.109 cents	$9, 310, 029. 88
Gold produced—26,669.667 ounces at $20.430	544, 853. 48
Silver produced—107,181.0553 ounces at 22.641 cents	24, 266. 38
	9, 879, 149. 74

Operating expenses:			
Mining, including stripping and development charge		$4,631,118.09	
Ore delivery—mine to mill		887,748.40	
Milling		2,876,272.93	
Treatment, freight and refining		3,449,488.36	
Selling commission		164,172.75	
			$12,008,800.53
Loss from operations			2,129,650.79
Miscellaneous income—net			797,232.63
Net loss			1,332,418.16
Charges against income:			
Depreciation		721,168.61	
Plant and equipment retirements		7,082.41	
			728,251.02
Net loss to surplus			2,060,669.18

SURPLUS FROM OPERATIONS

Balance—December 31, 1930			12,631,960.68
Loss for year (without provision for depletion)			2,060,669.18
			10,571,291.50
Charge against surplus for metal adjustments reserve		715,734.32	
Adjustments of accounts with subsidiaries for allocation of income taxes of prior years	$628,401.72		
Other credits to surplus	63,068.82		
		691,470.54	
		24,263.78	
Distributions to shareholders		3,885,798.40	
			3,910,062.18
Balance—December 31, 1931			6,661,229.32

The Peru Mining Co. operated the No. 2 unit of its Peru mill (at Deming) 66 days in 1931 on lead-free sulphide ore from its Pewabic mine at Hanover. The mine was operated 96 days; no new development was done in 1931. No important changes were made in the equipment of the Peru mill, described in the 1929 report of this series.

Other producing mines in the Central district (all small) were the Davidson, Eighty-Eight, and Three Brothers.

Chloride Flat district (*Silver City*).—No iron-manganese ore[10] was shipped from the Chloride Flat district in 1931.

Eureka (*Hachita*) *district* (*see also Eureka district*, *Hidalgo County*).—A lessee on the King "400" mine shipped 198 tons of silver ore containing a little copper and lead to the El Paso smelter. The Reed Mining Co. of Hachita shipped 80 tons of copper-silver-gold ore to the El Paso smelter.

Pinos Altos district.[11]—Shipments in 1931 from lode mines at Pinos Altos consisted of one 4-ton lot of lead-copper-silver-gold ore, one

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[10] Jones, E. L., jr., Deposits of Manganese Ore in New Mexico; Contributions to Economic Geology, 1919, Part I: U. S. Geol. Survey Bull. 710, 1920, pp. 37–60.
Wells, E. H., Manganese in New Mexico: New Mexico State School of Mines Bull., 1918.

[11] Paige, Sidney, The Ore Deposits near Pinos Altos, N. Mex.; Contributions to Economic Geology, 1910, Part I: U. S. Geol. Survey Bull. 470, 1911, pp. 109–125.

8-ton lot of gold ore, and one 3-ton lot of lead-silver-gold ore. Surface deposits at Pinos Altos yielded, by hand rockers and pans, 176.98 crude ounces of placer gold, which upon melting at the Denver Mint was reduced to 165.50 crude ounces averaging 0.771 fine in gold and 0.199 fine in silver.

GUADALUPE COUNTY

I. J. Stauber, who for several years prior to August 20, 1930, shipped copper ore from a surface deposit in secs. 6 and 7, T. 7 N., R. 20 E. of the New Mexico Principal Meridian, shipped no ore in 1931. The mine is developed by shallow shafts averaging 27 feet in depth; the ore is oxidized; the minerals are malachite and azurite. In 1930 the total quantity shipped was 10,123 tons averaging 4.89 per cent copper.

HIDALGO COUNTY

Eureka district (*Hachita*) (*see also Eureka district, Grant County*).—In 1931, 32 tons of lead-silver ore were shipped from Hachita, presumably from the Grant County side of the Eureka district. Of this quantity 11 tons were from the Lead Queen.

Gillespie (*or Red Hill*) *district* (*Hachita*).—In 1931 the Red Hill Leasing Co. shipped 252 tons of lead-silver-gold ore from the Red Hill mine, 28 miles south of Hachita.

Lordsburg district (*including Pyramid and Virginia or Shakespeare districts*).—Shipments of highly siliceous gold-silver-copper ore to smelters at Douglas, Ariz., and El Paso, Tex., in 1931 were 96,032 tons containing, in terms of recovered metals, $233,315 in gold, 137,731 ounces of silver, 3,991,700 pounds of copper, and 96,700 pounds of lead, with a total gross calculated value for the four metals of $640,080 compared with $998,479 in 1930.

The Eighty-Five mine[12] was operated by the Calumet and Arizona Mining Co. from January 1 to October 1, when it was transferred with other assets of the Calumet and Arizona Mining Co. to the Phelps Dodge Corporation. The latter operated the mine to December 31, 1931, when it was closed.

The Alamo Copper Co. operated the Atwood group, from which were shipped 8,970 tons of siliceous copper-silver-gold ore with a minor lead content. Development at this group in 1931 included 500 feet of shaft and 1,432 feet of drifts, making the total development a 3-compartment vertical shaft 800 feet deep and 1,700 feet of drifts and crosscuts. All operation was suspended on December 10, 1931.

The Anita Copper Co. was succeeded by the Wheeling-Lordsburg Copper Co. in May, 1931. These two companies operated the Octo group on a half-time basis from January 1 to September 1 and from Octo Nos. 2, 3, and 7 produced 1,460 tons of siliceous copper-silver-gold ore with a minor lead content. During 1931, 1,000 feet of drifts were driven, making a total development of one vertical 820-foot shaft and 5,000 feet of drifts.

Reynolds & Gwartney operated the Chance-Shoofly group, formerly known as the "Bonney" mine, and shipped 5,755 tons of siliceous copper-silver-gold ore.

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[12] Youtz, R. B., Mining Methods at the Eighty-Five Mines, Calumet and Arizona Mining Co., Valedon, N. Mex.: Inf. Circ. 6413, Bureau of Mines, 1931, 26 pp.

LINCOLN COUNTY

Nogal district.—In the Cedar Creek subdistrict of the Nogal district the Blok Mines (Inc.) did development work with a small crew throughout the year at the Silver Plume Nos. 1 to 29 claims. Seven of the claims are leased from the Alto Mining & Milling Co., and 22 were taken up by the Blok Mines (Inc.). These properties are in secs. 29, 30, 31, and 32, T. 10 S., R. 13 E. of the New Mexico Principal Meridian. Old workings on the property consist of a 200-foot adit and a vertical 110-foot shaft. New workings comprise a 185-foot adit. Oil-burning equipment was installed for firing a 150-horsepower water-tube boiler to operate a compressor and electric generator. For making tests minor rearrangements and repairs were made on the old mill. A small tonnage was milled in 1931, merely as a test. The resulting 3 tons of lead-copper-silver-gold concentrates were shipped to El Paso. The chief metal in the ore is silver. The Lead-Silver King Mines (Inc.) did development work in 1931 on the Zinc Contact Nos. 1 to 6 claims. For note on placer gold see below.

Red Cloud or Gallinas Mountains district.—The Real Del Monte Metals Co. did only development work on the Conqueror-Deadwood-Red Cloud group in the Red Cloud district 7 miles from Gallinas station. The company also did development work on the Miner Boy gold prospect 8 miles from Ancho and on the Surprise prospect 10 miles from Carrizozo.

Whiteoaks district.—A small gold bar with a fineness of 0.790 in gold and 0.094 in silver was shipped to the San Francisco Mint from small milling operations on the North Homestake dump. The El Aviador Gold Mining Co. drove 100 feet of new development on the group consisting of the Large Hopes, Little Nell, Rita, Lady Godiva, Solitaire, and Gold Field patented properties.

LINCOLN COUNTY PLACERS

Small panning and sluicing operations during 1931 produced placer bullion containing 20.27 ounces of gold and 7 ounces of silver. The bullion originating in the Jicarilla district ranged in fineness from 0.913 in gold and 0.082 in silver to 0.930 in gold and 0.062 in silver. Gold seemingly originating in the Nogal district averaged 0.706½ fine in gold and ranged from 0.261 to 0.292 fine in silver.

LUNA COUNTY

Deming district.—One unit of the 2-unit Peru selective flotation mill (total mill capacity, 300 tons per day) at Wemple near Deming was operated 66 days at an average rate of 110 tons per day on lead-free zinc sulphide ore from the Peru Mining Co. Pewabic mine at Hanover, Grant County.

There was no production in 1931 from any of the Luna County mining districts. Former producing districts are Cooks Peak, Florida Mountains, Tres Hermanas,[13] and Victorio. A brief history of these districts appears in the 1929 report of this series.

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[13] Lindgren, Waldemar, The Tres Hermanas Mining District, N. Mex.; Contributions to Economic Geology, 1908, Part I: U. S. Geol. Survey Bull. 380, 1908, pp. 123–128.

OTERO COUNTY

High Rolls (*Sacramento Mountains*) *district.*—As a result of location, annual assessment, and development work on many claims 9.9 miles south of High Rolls, the Adycupb Co. shipped a 13-ton lot of copper-silver ore to the El Paso smelter in 1931. All development at the property ceased early in the summer. Stewart & Holmes shipped 1,034 tons of siliceous lead-silver-copper ore to the El Paso smelter from the Alamo group 7.6 miles southwest of High Rolls in sec. 30, T. 16 S., R. 11 E. of the New Mexico Principal Meridian. The chief workings of the property at the end of 1931 were reported as 700 feet of tunnel, 1,500 feet of drifts, and a 600-foot incline shaft. The development work done in 1931 totaled 520 feet.

Orogrande district.—In a No. 5 Huntington mill a small quantity of gold ore from the Nancy Lee was treated with quicksilver to produce a small bar of bullion weighing 9.47 ounces. After being melted at the Denver Mint the bar weighed 5.03 ounces and averaged 0.613 fine in gold and 0.068 fine in silver. Another small bar (4.66 ounces) from the district weighed 4.59 ounces after being melted at the mint and averaged 0.388 fine in gold and 0.331 fine in silver.

SANDOVAL COUNTY

Cochiti (*Bland*) *district.*—Assessment work only was done in 1931 at the Lone Star and Crown Point groups in the Cochiti district. A small amount of development work was done during 1929–30. The district formerly produced silver; the last year of production was 1916.

SAN MIGUEL COUNTY

Willow Creek district (*Tererro*).—The American Metal Co. of New Mexico in 1931 operated its 600-ton selective flotation mill continuously, except for minor shutdowns for repairs, at a daily average of 505 tons. The mill is in Alamitos Canyon 6 miles by road from Glorieta station and 4 miles by railroad spur from Fox station on the Atchison, Topeka & Santa Fe Railway; it is connected with the mine (called the Pecos mine[14]) by a 12-mile aerial tram. The post office at the mine is called Tererro. In 1931 development work totaled 7,040 feet of drifts and crosscuts.

The actual heads of ore into the mill in 1931 averaged 0.111 ounce gold, 3.68 ounces silver, 5.06 per cent lead (wet assay), 0.81 per cent copper (wet assay), and 15.42 per cent zinc. The yield from 184,502 dry tons treated in 1931 was 44,780 tons of zinc concentrates—averaging 0.037 ounce gold, 3.22 ounces silver, 1.63 per cent lead (wet assay), 1.00 per cent copper (wet assay), 54.69 per cent zinc, and 6.37 per cent iron—and 18,911 tons of lead-copper concentrates—averaging

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[14] Stott, C. E., Geology of the Pecos Mine: Eng. and Min. Jour., vol. 131, Mar. 23, 1931, pp. 270–275.

Matson, J. T., and Hoag, C., Mining Practice at the Pecos Mine of the American Metal Co. of New Mexico: Inf. Circ. 6368, Bureau of Mines, 1930, 21 pp.

Bemis, H. D., Milling Methods and Costs at the Pecos Concentrator of the American Metal Co., Tererro, N. Mex.: Inf. Circ. 6605, Bureau of Mines, 1932, 23 pp.

Krieger, Philip, Geology of the Zinc-Lead Deposit at Pecos, N. Mex.—Part I: Econ. Geol., vol. 27, No. 4, June–July, 1932, pp. 344–364; Part II: Econ. Geol., vol. 27, No. 5, August, 1932, pp. 450–470.

Engineering and Mining Journal, vol. 133, No. 3, March, 1932, p. 179, gives operating loss as $437,129, net operating loss as $1,259,573, and net loss previous year as $1,125,494.

0.79 ounce gold, 22.23 ounces silver, 39.99 per cent lead (wet assay), 4.14 per cent copper (wet assay), 13.22 per cent zinc, and 11.01 per cent iron. The equipment of the mill was described in the 1929 report of this series.

The lead-copper concentrates were shipped in 1931 to the American Smelting & Refining Co. lead plant at El Paso. The zinc concentrates were shipped to the National Zinc Co. natural-gas retort plant at Bartlesville, Okla., and to the American Zinc & Chemical Co. (American Metal Co.) at Langeloth, Pa. The residues from the treatment of these zinc concentrates were not treated further in 1931.

SANTA FE COUNTY

Los Cerrillos district.—Assessment work only was done in the Los Cerrillos district in 1931.

Montezuma district.—Assessment work was done on the property of the John O. Jones Estate in secs. 1, 2, 11, and 12, T. 17 N., R. 11 E. of the New Mexico Principal Meridian. The property is opened by an adit 650 to 700 feet long, of which 45 feet were done in 1931. Zinc and copper minerals are found.

New Placers district (*Golden, San Pedro*).—No production was made in 1931 from lode mines in the New Placers district. At the Santa Fe mine in sec. 23, T. 12 N., R. 7 E. of the New Mexico Principal Meridian Stewart & Conner drove 25 feet of adit 100 feet lower than the former workings. There is a ¾-ton per hour Huntington mill on the property.

Placer mines in the Golden district in 1931 yielded 118.77 crude ounces of gold bullion, which after being melted at the Denver Mint weighed 113.50 ounces, containing 106.76 fine ounces of gold and 7 fine ounces of silver. Average gold fineness was 0.940; silver fineness ranged from 0.027 to 0.058.

SIERRA COUNTY

Apache, Cuchillo Negro district (*Chloride*).—No work of any kind was done in 1931 at the Silver Monument mine and mill 10 miles west of Chloride. In 1929–30 the Velie Metals Co. built a 100-ton flotation mill at the property and in 1930 operated it for about six months. In 1931 a 35-ton lot of copper-silver-gold material, probably a clean-up, was shipped from the property. The company was dissolved in November, 1931. H. V. Thomas shipped a 1-ton lot of gold-silver ore from Chloride to the El Paso smelter.

Las Animas district (*Hillsboro*).—In 1931 many small lots of ore were shipped from the Hillsboro district. The output was principally gold ore and totaled 469 tons carrying, in terms of recovered metals, 192.87 ounces of gold, 555 ounces of silver, 5,200 pounds of copper, and 7,700 pounds of lead, with a total gross calculated value for the four metals of $4,906. Most of the ore was from old dumps; but one 55-ton lot was from the Snake & Opportunity group, reopened by Head & Meyers, and 52 tons were gold-silver-lead ore shipped by H. D. Thompson and others from a prospect near the El Oro mine.

Placer mines in the Las Animas district yielded 91.14 ounces of gold and 7 ounces of silver. Several small lots of this placer gold were recovered by panning, rocking, and using small dry machines. The largest producer in the district was the Animas Consolidated Mines Co., which used a drag-line scraper to feed a trommel screen and a power-propelled rocker. Water was supplied to this operation from wells sunk in the vicinity. From February 20 to December 31, Gordon W. Bourke-Wilder and his wife operated a dry separator called the "Wilder" (driven by a ¾-horsepower air-cooled gasoline engine) with a reported capacity of 72 cubic yards in 24 hours. Bourke-Wilder reports that he first removed 2,200 yards of débris material before reaching the pay gravel, and then treated 800 yards of pay gravel through his machine. The fineness of the Animas Consolidated Mines Co. placer bullion was gold 0.944 and silver 0.056; that of the Wilder placer bullion was gold 0.910 and silver 0.058.

Pittsburg district.—The Fluorspar Mines of America shipped a 4-ton lot of lead ore to the El Paso smelter in 1931.

The Caballo Placer Mining Co., lessee of the Shandon placer, recovered a small weight of placer gold which averaged 0.963¾ fine in gold and 0.035 in silver. The property contains 1,270 acres of patented ground in T. 16 S., R. 4 W., opposite Arrey and 25 miles by road north of Hatch on a high bench on the east side of the Rio Grande; it is cut deeply by intermittent cloudburst streams from the Caballo Mountains. This placer ground has been known for many years and has been worked periodically with dry placer machines by Mexicans and others. The Caballo Placer Mining Co. in 1930 installed a 75-horsepower Diesel engine and triple Gould pump near the Rio Grande and in 1931 built a reservoir above the placer ground.

SOCORRO COUNTY

Good Fortune district (40 miles west of Tularosa).—In 1931 at the Bella Vista prospect 60 feet of development work were done, and a car of copper-silver ore was shipped to the El Paso smelter. The main workings of the prospect consist of a 400-foot adit.

Hansonberg district (17 miles southeast of Carthage).—In 1930 the abandoned Escaprosa group was relocated, and two cars of copper-silver ore were mined and shipped to the El Paso smelter; in 1931, owing to the low prices of metals, assessment work only was done on these claims.

Magdalena district (Kelly, Magdalena).—No ore was shipped in 1931 from the formerly productive Magdalena mining district. The 1929 report of this series shows the production from 1904 to 1929 and the 1930 report that from 1921 to 1930. In 1931 very little development work was done on patented claims, and only necessary assessment work was done on claims held by location.

Mockingbird district.—Assessment work was done on the Sunrise Nos. 1 and 2 claims in Taylor Canyon in the Mockingbird district. Bismuth and molybdenum minerals are reported.

Rosedale district.—In the Rosedale district 30 miles northwest of San Marcial and 30 miles southeast of Magdalena no work was done in 1931. The openings on the Noonday properties are reported as a 40-foot shaft, a 150-foot adit, and 50 feet of drifts. At the Rosedale mine, formerly a gold producer, the main workings consist of a 735-foot shaft and about 5,000 feet of drifts. The mine was last worked in 1910; there was a clean-up in 1911. The 50-ton cyanide plant on the property burned in September, 1910. It treated 4,917 tons in 1909 and about 1,300 tons in 1910.

Salinas Peak district.—In 1931, 150 feet of development work were done on the Salinas Chief group, and a 7-ton lot of lead-silver ore was shipped to the El Paso smelter. The total development to the end of 1931 consists of a 150-foot adit and 150 feet of drifts.

TAOS COUNTY

Red River district.—In 1931 a 25-ton lot of gold and silver ore was shipped to the El Paso smelter from the Memphis property by the Bitter Creek Leasing Co. Many new claims were located in the Red River district during 1931, and assessment work was done on previous locations. Prospects in the district include the Big Four, Black Copper (patented), Caribel, Champion, Crow, Gold Roof-Gold Ledge, Golden Treasure, Independence, Indiana, Last Chance-Lulu-Mamie-Stella, Silver King, Silver Tip-New York-Ajax, and Willard.

Sulphur Creek district.—The Molybdenum Corporation of America continued to mill molybdenum ore from the Phyllis group at its 40-ton (per 24 hours) flotation mill at the junction of Sulphur Creek and Red River above Questa.

TORRANCE COUNTY

Scholle district.—No copper ore was shipped from the Scholle district in 1931. Sporadically in the past, whenever copper prices were high, copper ore has been shipped from this district from shallow ore bodies in the " Red Beds "; in 1930 only 120 tons of ore containing 3.93 per cent copper and 0.5 ounce silver to the ton were shipped; in 1929 the output was 2,001 tons containing 4.18 per cent copper and 0.7 ounce silver to the ton.

VALENCIA COUNTY

In 1931 assessment work was done at the Valencia Corporation group near Diener (21 miles southwest of Grant) in the Copper Hill district in secs. 17, 18, 19, and 20, T. 11 N., R. 12 W. of the New Mexico Principal Meridian.

GOLD, SILVER, COPPER, AND LEAD IN TEXAS[1]

(MINE REPORT)

By C. W. Henderson

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SUMMARY

The mine production of gold, silver, copper, and lead in Texas from 1927 to 1931 is shown in the following table. The total production of gold in Texas from 1885 to 1931, inclusive, according to Henderson,[2] is $95,073, and that of silver is 22,772,523 ounces.

Mine production of gold, silver, copper, and lead in Texas, 1927–1931, in terms of recovered metals [1]

Year	Ore (short tons)	Gold	Silver		Copper		Lead		Total value
			Fine ounces	Value	Pounds	Value	Pounds	Value	
1927	50,759	$8,192	1,034,866	$586,769	21,458	$2,811	487,984	$30,743	$628,515
1928	76,915	10,115	1,340,622	784,264	447,792	64,482	695,570	40,343	899,204
1929	63,872	26,439	1,020,516	543,935	341,000	60,016	849,683	53,530	683,920
1930	31,147	3,648	389,239	149,857	143,100	18,603	396,820	19,841	191,949

[1] No production in 1931.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064	1930	$0.385	$0.130	$0.050	$0.048
1928	.585	.144	.058	.061	1931	.290	.091	.037	.038
1929	.533	.176	.063	.066					

REVIEW BY COUNTIES

No ore carrying gold, silver, copper, or lead was shipped from Texas mines in 1931. The 1929 and 1930 reports of this series give details of development and descriptions of milling plants by counties and districts.

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[1] Work on manuscript completed November, 1932.

[2] For production from 1885 to 1927 and prices used in calculating values see Henderson, C. W., Mineral Resources, 1927, Pt. I, pp. 477 and 478. *See also* Henderson, C. W., Mineral Resources, 1914, Pt. I, p. 236.

EL PASO COUNTY

The copper-smelting works and lead plant of the American Smelting & Refining Co. are at El Paso. At the end of 1931 the copper works consisted of 2 reverberators, with a total annual capacity of 600,000 tons of ore, and 3 converters; and the lead plant was equipped with 3 furnaces having a total annual capacity of 200,000 tons. The lead plant treats much lead ore from Mexico; it also treats lead ore from Arizona, New Mexico, and Texas, as well as zinc residues from Oklahoma. The copper plant was built originally in 1910 to handle copper concentrates from Chino Mines at Santa Rita, N. Mex.; it also receives copper ore and concentrates from Arizona. Natural gas for fuel was introduced in these plants in 1930.[3]

The Nichols electrolytic copper refinery, also at El Paso, was completed and set in operation in 1930 to treat copper anodes produced at the Arizona smelters of the Phelps Dodge Corporation and the Calumet and Arizona Mining Co. The yearly capacity is 100,000 tons of anodes.[4] The plant was not operated at full capacity during 1931.

PRESIDIO COUNTY

From 1885 to 1930, inclusive, the Presidio mine at Shafter, Tex., has produced (in terms of recovered metal) 20,282,186 ounces of silver. The property was closed June 30, 1930, owing to the declining price of silver, but the mine contains reserves of silver ore. As it is a dry mine—that is, has no water problem—it can be reopened without difficulty if and when the management decides that the price of silver warrants reopening.

Production of silver from the Presidio mine,[a] 1885–1930 [b]

Period	Mill heads treated (short tons)	Silver content of mill heads (ounces)		Recovery of silver	
		Per ton	Total	Per cent	Ounces
1885–1912	450,000	25.84	11,628,000	81.68	9,497,750
1913–1926	720,000	12.00	8,640,000	83.66	7,228,224
1927	48,190	22.87	1,102,105	[c] 91.41	[c] 1,004,384
1928	57,475	23.17	1,331,696	91.04	1,212,340
1929	54,644	19.74	1,078,673	90.30	974,049
Total, 1885–1929	1,330,309	17.88	23,780,474		19,916,747
1930	24,985	(?)	(?)	(?)	365,439
Total, 1885–1930	1,355,294	(?)	(?)	(?)	20,282,186

[a] Howbert, Van Dyne, and Gray, F. E., Milling Methods and Costs at Presidio Mine of the American Metal Co. of Texas: Am. Inst. Min. and Met. Eng., Tech. Pub. 368, 1930; Howbert, Van Dyne, and Bosustow, Robert, Mining Methods and Costs at Presidio Mine of the American Metal Co. of Texas: Am. Inst. Min. and Met. Eng., Tech. Pub. 334, 1930.

[b] No production in 1931.

[c] Using the company's 1927 report of 1,004,384 ounces of silver recovered gives 91.13 per cent recovery; using 91.41 per cent (Howbert and Gray, work cited, p. 6) as recovery gives 1,007,434 ounces of silver recovered.

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[3] Marble, E. R., Natural Gas Firing at El Paso Smelting Works: Min. and Met., October, 1930, pp. 466–467.

[4] Robie, E. H., A Trip Through the New Nichols Copper Refinery at El Paso, Tex.: Eng. and Min. Jour., vol. 129, January, 1930, pp. 5–10; Furnace and Casting Equipment of the New Nichols Refinery: Eng. and Min. Jour., vol. 129, January, 1930, pp. 73–76. Corwin, F. R., and Harloff, C. S., El Paso Refinery of the Nichols Copper Co.: Min. and Met., October, 1930, pp. 459–465.

SECONDARY METALS[1]

By J. P. Dunlop[2]

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INTRODUCTION

SCOPE OF REPORT

"Secondary metals" are those recovered from scrap metal, sweepings, skimmings, and drosses and are so called to distinguish them from metals derived directly from ores, which are termed "primary metals." The distinction does not imply that secondary metals are of inferior quality, for metals derived either from ore or from waste material vary in purity and in adaptability to use in making certain products. The figures furnished by producers cover seven metals—secondary copper, lead, zinc, tin, antimony, aluminum, and nickel—and supplement those on the primary metals. They are given to enable producers and consumers to form a more comprehensive idea of the quantities of metal available for consumption; in fact, they constitute an essential addition to the figures given in the general reports on the primary metals and will become more essential in the future.

RECOVERY, TREATMENT, AND USE OF WASTE MATERIAL

The variety of waste material (especially metallic wastes), its utilization, and much information relating to its collection and disposal are given in reports of this series for preceding years. These reports also name the various trade papers that cover the subject of secondary metals.

Trade publications of recent date contain the following articles of interest.

Wright, T. A. Random thoughts of a consulting chemist on salvage. Nat. Waste Rev., December, 1931, pp. 41–43.

Bangs, G. H. Saving by substitution of other material. Nat. Waste Rev., July, 1932, pp. 5–7.

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[1] Work on manuscript completed July, 1932.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Gerline, Otto. How shall we take the pressure out of depression in the brass foundry? Metal Ind., May, 1932, pp. 195–196.

Barth, Otto. Duty on copper and its effect on the scrap trade. Waste Trade Rev., Oct. 17, 1931, pp. 3 and 17.

CLASSIFICATION OF OLD METALS

The classification of old metals drawn up by the metals division of the National Association of Waste Material Dealers (Inc.), Times Building, New York, N. Y., and changed from time to time as desirable, is the standard of both dealers and manufacturers in the United States. The latest classification (Circular M), effective March 16, 1932, follows. Attention is directed to items 9, 27, 28, 29, 31, 32, and 33, which show changes in the specifications relating to brass cocks and faucets and scrap-aluminum wire, cable, sheet, etc.

Standard Classification for Old Metals, Effective from March 16, 1932

1. *Delivery.*—(*a*) Delivery of more or less of the specified quantity up to 1¼ per cent is permissible.

(*b*) If the term "about" is used, it is understood that 5 per cent more or less of the quantity may be delivered.

(*c*) Should the seller fail to make deliveries as specified in the contract, the purchaser has the option of canceling all of the uncompleted deliveries or holding the seller for whatever damages the purchaser may sustain through failure to deliver, and if unable to agree on the amount of damages an arbitration committee of the National Association of Waste Material Dealers (Inc.), appointed for this purpose, to determine the amount of such damages.

(*d*) In the event that buyer should claim the goods delivered on a contract are not up to the proper standard, and the seller claims that they are a proper delivery, the dispute shall be referred to an arbitration committee of the National Association of Waste Material Dealers (Inc.), to be appointed for that purpose.

(*e*) A carload, unless otherwise designated, shall consist of the weight governing the minimum carload weight at the lowest carload rate of freight in the territory in which the seller is located. If destination of material requires a greater carload minimum weight, buyer must so specify.

(*f*) A ton shall be understood to be 2,000 pounds unless otherwise specified. On material purchased for direct foreign shipment a ton shall be understood to be a gross ton of 2,240 pounds unless otherwise specified.

(*g*) If, through embargo, a delivery can not be made at the time specified, the contract shall remain valid and shall be completed immediately on the lifting of the embargo, and terms of said contract shall not be changed.

(*g*–1) When shipments for export for which space has been engaged have been delivered or tendered to a steamship for forwarding and through inadequacy of cargo space the steamship can not accept the shipment, or where steamer is delayed in sailing beyond its scheduled time, shipment on the next steamer from the port of shipment shall be deemed a compliance with the contract as to time of shipment.

(*h*) In case of a difference in weight and the seller is not willing to accept buyer's weights, a sworn public weigher shall be employed, and the party most in error must pay the costs of handling and reweighing.

(*i*) When material is such that it may be sorted by hand, consignees can not reject the entire shipment if the percentage of rejection does not exceed 10 per cent. The disposition of the rejected material should then be arranged by negotiations; no replacement of the rejected material to be made.

Upon request of the shipper, rejections shall be returnable to the seller on domestic shipments within one week and on foreign shipments within 30 days from the time notice of rejection is received by them, and upon payment by them of 1 cent a pound on material rejected to cover cost of sorting and packing; the seller to be responsible for freight both ways.

2. *No. 1 copper wire.*—To consist of clean untinned copper wire not smaller than No. 16 B. & S. Wire gage to be free from burnt copper wire which is brittle and all foreign substances.

3. *No. 2 copper wire.*—To consist of miscellaneous clean copper wire which may contain a percentage of tinned wire and soldered ends but to be free of hair wire

and burnt wire which is brittle; the tinned wire not to be over 15 per cent of the total weight.

4. *No. 1 heavy copper.*—This shall consist of untinned copper not less than $\frac{1}{16}$ inch thick, and may include trolley wire, heavy field wire, heavy armature wire, that is not tangled, and also new untinned and clean copper clippings and punchings, and copper segments that are clean.

5. *Mixed heavy copper.*—May consist of tinned and untinned copper, consisting of copper clippings, clean copper pipe and tubing, copper wire free of hair wire and burnt and brittle wire, free from nickel-plated material.

6. *Light copper.*—May consist of the bottoms of kettles and boilers, bathtub linings, hair wire, burnt copper wire which is brittle, roofing copper and similar copper, free from radiators, brass, lead and solder connections, readily removable iron, old electrotype shells, and free of excessive paint, tar, and scale.

7. *Composition or red brass.*—May consist of red scrap brass, valves, machinery bearings and other parts of machinery, including miscellaneous castings made of copper, tin, zinc and/or lead, no piece to measure more than 12 inches over any one part or to weigh over 60 pounds, to be free of railroad boxes and other similarly excessively leaded material, cocks and faucets, gates, pot pieces, ingots, and burned brass, aluminum composition, manganese, and iron.

8. *Railroad bearing.*—Shall consist of railroad boxes or car journal bearings, must be old standard used scrap, free of yellow boxes, also iron-backed boxes, and must be free of babbitt, also free of excessive grease and dirt.

9. *Cocks and faucets.*—To be mixed red and yellow brass, free of gas cocks and beer faucets, and to contain a minimum of 35 per cent red.

10. *Heavy yellow brass.*—May consist of heavy brass castings, rolled brass, rod brass ends, chandelier brass, tubing, not to contain over 15 per cent of tinned and/or nickel-plated material; no piece to measure more than 12 inches over any one part and must be in pieces not too large for crucibles. Must be free of manganese mixture, condenser tubes, iron, dirt and excessive corroded tubing. Must be free of aluminum brass containing over 0.20 per cent aluminum.

11. *Yellow brass castings.*—Shall consist of brass castings in crucible shape, that is, no piece to measure more than 12 inches over any one part; must be free of manganese mixtures, tinned and nickel-plated material, and must be free of visible aluminum brass.

12. *Light brass.*—May consist of miscellaneous brass, tinned or nickel plated that is too light for heavy brass, to be free of gun shells containing paper, ashes or iron, loaded lamp bases, clock works, and automobile gaskets. Free of visible iron unless otherwise specified.

13. *Old rolled brass.*—May consist exclusively of old pieces of sheet brass and pipe free from solder, tinned and nickel-plated material, iron, paint, and corrosion, ship sheathing, rod brass, condenser tubes, and Muntz metal material.

14. *New brass clippings.*—Shall consist of the cuttings of new sheet brass to be absolutely clean and free from any foreign substances and not to contain more than 10 per cent of clean brass punchings to be not smaller than $\frac{1}{4}$ inch in diameter.

15. *Brass pipe.*—Shall consist of brass pipe, free of nickel-plated, tinned, soldered, or pipes with cast brass connections. To be sound, clean pipes free of sediment and condenser tubes.

16. *No. 1 red composition turnings.*—To be free of railroad car box turnings and similarly excessively leaded material, aluminum, manganese, and yellow brass turnings; not to contain over 2 per cent free iron; to be free of grindings and foreign material, especially babbitt. Turnings not according to this specification to be sold subject to sample.

17. *No. 1 yellow rod brass turnings.*—Shall consist of strictly rod turnings, free of aluminum, manganese, composition, Tobin and Muntz metal turnings; not to contain over 3 per cent free iron, oil, or other moisture; to be free of grindings and babbitts; to contain not more than 0.30 per cent tin and not more than 0.15 per cent combined iron.

18. *No. 1 yellow brass turnings.*—Shall consist of yellow brass turnings, free of aluminum, manganese, and composition turnings; not to contain over 3 per cent of free iron, oil, or other moisture; to be free of grindings and babbitts. To avoid dispute, to be sold subject to sample.

19. *Auto radiators (unsweated).*—All radiators to be subject to deduction of actual iron. The tonnage specification should cover the gross weight of the radiators, unless otherwise specified.

20. *No. 1 pewter.*—Shall consist of tableware and soda-fountain boxes, but in any case must test 84 per cent tin. Siphon tops to be treated for separately.

21. *Zinc.*—Must consist of clean sheet and cast zinc, also cast batteries to be free of loose oxide and dross, sal ammoniac cans, and other foreign materials.

22. *Zinc dross.*—Must be unsweated in slabs and must contain a minimum of 92 per cent of zinc.

23. *Tin foil.*—Shall consist of pure foil free of lead compositions and other foreign ingredients and matters.

24. *Electrotype shells.*—Must be hand picked and free of loose dross and chunks of dross.

25. *Scrap lead.*—Should be clean, soft scrap lead.

26. *Battery lead plates.*—Shall consist of dry battery lead plates, moisture not to exceed 1 per cent, allowance to be made for wood, rubber, and paper and excess moisture, or lead plus antimony content, dry basis, less a treatment charge.

27. *New pure aluminum clippings.*—Shall consist of new, clean, unalloyed sheet clippings and/or aluminum sheet cuttings. Must be free from oil, grease, and any other foreign substance. Also to be free from punchings less than one-half inch square.

28. *New pure aluminum wire and cable.*—Shall consist of new, clean, dry, unalloyed aluminum wire or cable, free from iron, insulation and any other foreign substance.

29. *Old pure aluminum wire and cable.*—Shall consist of old, unalloyed aluminum wire or cable containing not over 1 per cent free oxide or dirt and free from iron, insulation and any other foreign substance.

30. *Alloy sheet aluminum.*—To be sold on specification and sample.

31. *Painted sheet aluminum.*—Shall consist of clean, old, painted, unalloyed sheet aluminum, guaranteed free from iron, dirt, and any other foreign substance. To contain no radiator shells or aeroplane sheet.

32. *Old scrap sheet aluminum.*—Shall consist of clean, old, unalloyed sheet or manufactured sheet aluminum, guaranteed free from iron, dirt, or any other foreign substance, and to be free from hub caps, radiator shells and aeroplane sheet.

33. *Scrap aluminum castings.*—Shall consist of clean, heavy automobile castings, containing not more than 12 per cent industrial mixed castings, and to be free from die cast aluminum, pattern metal and hat blocks. All of above material also to be free from iron, babbitt, brass and any other foreign substance. Oil and grease must not exceed 2 per cent.

34. *Aluminum borings.*—To avoid dispute, should be sold subject to sample.

35. *Aluminum foil.*—Shall consist of pure aluminum foil, free from paper and any foreign ingredients.

36. *Babbitt metal.*—Shall contain bearing metal of all kinds. Shall not contain scrap hard metal, Allen metal (which is copper and lead alloy) die cast, ornamental metal, casket metal, zinc boxes or type metal.

37. *Packages.*—Shall be good strong packages suitable for shipment and each package shall be plainly marked with separate shipping marks and numbers and with the gross and tare weights so that the packages may reach their destination and their weights can be easily checked.

There is a growing demand for scrap-metal specialties (not specifically covered by the preceding classification), such as nickel alloys, German silver, Monel metal, cadmium, and molybdenum. Difficulties in making shipments to buyers' specifications have arisen, and with the object of eliminating some of the trouble the Waste Trade Journal has published certain classifications used by one of its advertisers. A list of these was given on pages 338 and 339 of the 1930 report of this series.

REVIEW OF SECONDARY METAL INDUSTRY IN 1931

MARKET CONDITIONS

The total value of certain nonferrous metals, for which the quantity recovered from secondary sources is reported to the Bureau of Mines, was $110,674,600 in 1931, a decrease of $82,580,500 (43 per cent) from 1930; the total quantity decreased 21 per cent. The decrease in total value was due partly to the much lower average prices in 1931 of copper, lead, zinc, tin, and antimony. The main decrease in secondary metals recovered in 1931 was in copper and brass, which declined 27 per cent in total quantity and 48 per cent in total value.

Shipments of scrap copper to Europe doubled those in 1930, whereas shipments of scrap brass declined. Smelters that treat mainly primary material produced about 62,200 tons less secondary copper in 1931 than in 1930.

Secondary lead recovered by smelters that treat mainly ore and bullion decreased 9 per cent, and the output of lead in alloys by secondary smelters that treat drosses and scrap alloys decreased 22 per cent.

Zinc recovered by redistillation decreased about 13,200 tons; the quantity of zinc recovered in scrap brass was much less in 1931 than in 1930.

Detinning plants treated about 27,600 long tons less clean tin-plate clippings in 1931 than in 1930; the yield of tin per ton was the same. The decrease in quantity recovered was largely in tin contained in alloys, such as solder, babbitt, and bronze.

As prices of primary metals trended steadily downward and as most metals had their lowest prices at the end of 1931 the prices for scrap metals, alloys, and residues declined so that dealers and secondary smelters had little opportunity to sell material at a profit and the gathering of secondary metals at their source was greatly retarded. Many foundries were idle or operated on a much reduced scale, and their purchases of scrap metals and composition ingots were spasmodic and in small lots.

PRICES OF SOME SCRAP METALS AND ALLOYS

The tables that follow show certain scrap-metal prices at New York in 1931, as quoted by the Waste Trade Journal and the American Metal Market.

The dealers' weekly average buying price in New York of No. 1 heavy scrap copper ranged from 7.625 to 4.5 cents a pound, a spread of 3.125 cents in 1931 compared with 6.125 cents in 1930.

No. 1 composition scrap (red brass) showed a spread of 3.25 cents a pound in 1931 compared with 4.25 cents in 1930.

Quotations for heavy lead ranged from 4 to 2.625 cents a pound, with the highest in January and the lowest in October.

The range in the price of old scrap zinc was 0.75 cent a pound in 1931 compared with 1.25 cents in 1930.

The range in the quoted price of cast aluminum was 2 cents in 1931 compared with 5.125 cents in 1930. The highest quotation in 1931 was 5.125 cents in January; the lowest was 3.125 cents in October and November.

Average scrap-metal prices in 1931, in cents per pound [1]

[New York dealers' weekly average buying prices f. o.b. New York]

Date	No. 1 copper and wire, miscellaneous	No. 1 composition	Heavy lead	Old zinc	Cast aluminum, mixed	Date	No. 1 copper and wire, miscellaneous	No. 1 composition	Heavy lead	Old zinc	Cast aluminum, mixed
Jan. 3	7.62½	6.87½	4.00	1.62½	5.12½	July 4	6.25	5.25	3.12½	1.00	3.75
10	7.62½	6.87½	3.62½	1.62½	5.12½	11	5.75	4.75	3.25	1.00	3.75
17	7.62½	6.87½	3.62½	1.62½	5.12½	18	5.62½	4.62½	3.25	1.00	3.50
24	7.62½	6.87½	3.62½	1.62½	5.12½	25	5.62½	4.62½	3.25	1.00	3.50
31	7.62½	6.87½	3.62½	1.62½	5.12½	Average	5.81	4.81	3.22	1.00	3.62½
Average	7.62½	6.87½	3.70	1.62½	5.12½	Aug. 1	5.62½	4.62½	3.25	1.00	3.50
Feb. 7	7.12½	6.37½	3.37½	1.62½	4.75	8	5.37½	4.37½	3.25	1.00	3.50
14	7.12½	6.37½	3.37½	1.62½	4.75	15	5.37½	4.37½	3.25	1.00	3.50
21	7.37½	6.62½	3.37½	1.62½	4.75	22	5.37½	4.37½	3.25	1.00	3.50
28	7.37½	6.62½	3.37½	1.62½	4.75	29	5.37½	4.37½	3.25	1.00	3.50
Average	7.25	6.50	3.37½	1.62½	4.75	Average	5.42½	4.32½	3.25	1.00	3.50
Mar. 7	7.37½	6.62½	3.37½	1.62½	4.75	Sept. 5	5.37½	4.37½	3.25	1.00	3.50
14	7.37½	6.62½	3.37½	1.62½	4.75	12	5.25	4.25	3.25	1.00	3.50
21	7.37½	6.37½	3.37½	1.37½	4.75	19	5.12½	4.12½	3.12½	1.00	3.50
28	7.37½	6.37½	3.37½	1.37½	4.62½	26	5.12½	4.12½	3.12½	1.00	3.50
Average	7.37½	6.50	3.37½	1.50	4.72	Average	5.22	4.22	3.19	1.00	3.50
Apr. 4	7.12½	6.12½	3.37½	1.37½	4.62½	Oct. 3	4.62½	3.87½	3.12½	1.00	3.50
11	7.12½	6.12½	3.22½	1.37½	4.62½	10	4.62½	3.87½	2.87½	.95	3.37½
18	7.12½	6.12½	3.22½	1.37½	4.62½	17	4.62½	3.87½	2.87½	1.95	3.37½
25	7.12½	6.12½	3.22½	1.37½	4.62½	24	4.62½	3.87½	2.62½	.95	3.37½
Average	7.12½	6.12½	3.26½	1.37½	4.62½	31	4.62½	3.87½	2.75	.95	3.12½
May 2	6.87½	5.87½	3.00	1.00	4.62½	Average	4.62½	3.87½	2.85	.96	3.35
9	6.62½	5.62½	2.87½	1.00	4.37½	Nov. 7	4.62½	3.87½	2.75	.95	3.12½
16	6.62½	5.62½	2.75	1.00	4.37½	14	4.87½	4.12½	2.87½	.95	3.12½
23	6.12½	5.12½	2.75	1.00	4.37½	21	4.75	3.87½	3.00	1.00	3.37½
30	5.87½	4.87½	2.75	1.00	4.37½	28	4.50	3.62½	2.75	1.00	3.37½
Average	6.42½	5.42½	2.82½	1.00	4.42½	Average	4.69	3.87½	2.84½	.97½	3.25
June 6	5.75	4.75	2.75	.87½	4.37½	Dec. 5	4.50	3.62½	2.75	1.00	3.37½
13	5.87½	4.87½	2.75	.87½	4.37½	12	4.50	3.62½	2.75	1.00	3.37½
20	5.87½	4.87½	2.87½	.87½	4.00	19	4.50	3.62½	2.75	1.00	3.37½
27	6.25	5.25	3.12½	1.00	3.75	26	4.75	3.87½	2.75	1.00	3.37½
Average	5.93½	4.93½	2.87½	.90½	4.12½	Average	4.56	3.69	2.75	1.00	3.37½

[1] Waste Trade Journal, New York, Jan. 30, 1932.

The following monthly average prices at New York in 1931 for new scrap-zinc clippings, old zinc, block-tin pipe, and new aluminum clippings, in cents per pound, were quoted by the American Metal Market.

Average scrap-metal prices at New York in 1931, in cents per pound [1]

Month	New scrap-zinc clippings	Block-tin pipe	New aluminum clippings	Month	New scrap-zinc clippings	Block-tin pipe	New aluminum clippings
January	2.37	20.50	12.20	August	2.12	18.78	13.00
February	2.15	20.50	12.50	September	2.19	20.98	13.25
March	2.10	20.64	12.67	October	2.18	17.87	13.03
April	1.94	21.02	13.75	November	2.06	17.87	12.87
May	1.94	17.50	13.75	December	2.06	16.95	12.82
June	1.96	17.68	13.75				
July	2.18	18.50	13.29	Year	2.10	19.07	13.07

[1] Metal Statistics, 1932

SECONDARY METALS RECOVERED

The quantity of metals contained in numerous alloys made partly or wholly from secondary material can not be ascertained definitely. The figures given as the result of the annual canvass are only approximate, but they constitute the sole available data on an important industry.

The large decrease in the value of the secondary metals, exclusive of gold, silver, platinum, iron, steel, and ferro-alloys, recovered in the United States in 1931 was due mainly to the smaller quantity of copper and copper alloys treated and to the lower average price of copper. There were, however, substantial decreases in the prices and quantities of lead, zinc, aluminum, antimony, and tin. The recovery of secondary nickel decreased, but the average price remained stable.

The quantity of secondary platinum metals recovered in the United States in 1931 was 43,734 troy ounces (3,582 ounces less than in 1930) and was equivalent to 33.7 per cent of the platinum metals imported for consumption.

The value of the gold and silver contained in old jewelry, dental waste, tableware, ornaments, and other articles remelted or refined in 1931 was $21,956,356. Mints and refineries reported the recovery of 6,980,060 fine ounces of silver and $19,932,139 in gold from waste or discarded material. Jewelry and dental waste furnish the largest quantity of secondary gold, and silverware and photographic waste furnish the largest quantity of secondary silver. Most of the silver recovered from photographic wastes is obtained from solutions and is recovered by makers of films and plates. The consumption of silver in the photographic industry in the United States in 1931 was 6,605,623 ounces.[3]

No data are collected by the Bureau of Mines showing the quantity of secondary ferrous metals and alloys collected and sold for remelting or the quantity and value of old rails, pipe, machinery, and other equipment renovated for original use. A cursory glance at newspapers and trade publications shows that an enormous quantity of such ferrous material is salvaged and reused.

Secondary metals of certain classes recovered in the United States, 1930 and 1931

	1930		1931	
	Short tons	Value	Short tons	Value
Copper, including that in alloys other than brass	332,800	$86,528,000	261,000	$47,502,000
Brass scrap remelted	192,000	39,000,000	122,800	17,932,000
Lead as metal	129,000	25,580,000	128,800	17,367,800
Lead in alloys	126,800		105,900	
Zinc as metal	49,300	5,472,000	34,800	3,207,200
Zinc in alloys other than brass	7,700		7,400	
Tin as metal	5,600	16,228,300	5,500	9,428,800
Tin in alloys and chemical compounds	20,600		14,300	
Antimony as metal and in alloys	8,082	1,239,800	7,900	1,061,800
Aluminum as metal	19,700	17,177,000	15,200	12,726,000
Aluminum in alloys	18,900		15,100	
Nickel as metal	500	2,030,000	270	1,449,000
Nickel in nonferrous alloys and salts	2,400		1,800	
	913,382	193,255,100	720,770	110,674,600

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[3] Merrill, C. W., Silver Consumption in the Arts and Industries of the United States in 1930 and 1931. Inf. Circ. 6647, Bureau of Mines, 1932, 7 pp.

SECONDARY COPPER

Secondary copper recovered in the United States, 1930 and 1931, and imports and exports of brass and copper scrap, in short tons

	1930	1931
Copper as metal	[1] 244,800	[1] 188,300
Copper in alloys other than brass	88,000	72,700
	332,800	261,000
Copper from new scrap (not including brass)	62,700	45,000
Copper from old scrap (not including brass)	270,100	216,000
	332,800	261,000
Brass scrap remelted:		
New clean scrap	89,000	58,100
Old scrap	103,000	64,700
	192,000	122,800
Copper content of brass scrap (averaging 70 per cent copper):		
New scrap	62,300	40,700
Old scrap	72,100	45,300
	134,400	86,000
Total secondary copper (including copper content of brass scrap):		
From new scrap	125,000	85,700
From old scrap	342,200	261,300
	467,200	347,000
As metal	244,800	188,300
In brass and other alloys	222,400	158,700
	467,200	347,000
Brass scrap imported	3,573	2,212
Scrap copper imported	3,750	2,550
Brass scrap exported	22,613	11,592
Scrap copper exported	16,943	33,589

[1] Of these totals secondary copper reported by smelters and refiners that treat mainly primary metal comprised 140,270 tons in 1930 and 78,064 tons in 1931.

The copper produced by smelters of secondary material includes 110,236 tons of pig copper, 72,700 tons of copper in alloys other than brass, and 86,000 tons of copper in remelted brass. These figures indicate a small increase in production of pig copper but decreases of 15,300 tons in alloys other than brass and 48,400 tons in remelted brass.

The figures for secondary copper show that the relative decrease in 1931 in recovery of copper from scrap by regular smelters was much larger than that by secondary smelters.

The total value of secondary copper as metal and in brass and other alloys computed at 9.1 cents a pound—the average price in 1931 for all merchantable grades of new metal—was $63,154,000, only slightly more than one-half of the value in 1930.

Imports of scrap copper decreased from 3,750 tons in 1930 to 2,550 tons in 1931; the duty imposed in June, 1932, will probably cause imports to cease.

Combined exports of scrap copper and scrap brass in 1931 increased 14 per cent over those in 1930; exports of brass scrap decreased nearly one-half, whereas exports of scrap copper nearly doubled.

Railroads are among the largest producers of scrap metals but are not very large consumers of secondary metals. Reports for 1931 show that the railroads reused at their shops or plants the following quantities of scrap metals: 2,000 tons of brass; 500 tons of copper; 10,400 tons of copper in alloys other than brass; 1,250 tons of tin in babbitt, solder, and bronze; and 3,600 tons of lead in various alloys.

J. W. Furness, Minerals Division, Bureau of Foreign and Domestic Commerce, has issued a survey of the flow in 1930 of secondary copper and brass purchased in certain areas by brass plants, primary and secondary smelters, etc. Owing to the depression in the metal trades 1930 was not a representative year for such data; moreover, complete cooperation could not be obtained from the interested smelters and foundries. A copy of the survey by Furness may be obtained by application to the Department of Commerce.

SECONDARY LEAD

Secondary lead recovered in the United States, 1930 and 1931, in short tons

	1930	1931
Secondary lead recovered by smelters that treat mainly ore	48,135	43,774
Secondary lead recovered by smelters that treat only scrap and drosses	80,865	85,026
	129,000	128,800
Secondary lead recovered in remelted alloys:		
Estimated secondary lead content of antimonial lead produced at regular lead smelters [1]	[2] 9,804	14,173
Lead content of drosses and scrap alloys treated at secondary smelters	116,996	91,727
	126,800	105,900
Total secondary lead recovered	255,800	234,700

[1] In 1930 antimonial lead produced at regular lead smelters was classified as primary and secondary; in 1931 such classification was discontinued.

[2] The figure for 1930 represents lead content of material classified as secondary antimonial lead.

Refined primary lead produced in the United States, 1930 and 1931, in short tons

	1930	1931
From domestic ore	573,740	390,260
From foreign ore and base bullion	69,293	52,504

The output of secondary lead in 1931 was equivalent to 53 per cent of the total output of refined primary lead in the United States.

Secondary lead recovered by smelters whose product is mainly primary metal decreased nearly 4,400 tons, and that recovered in alloys decreased 20,900 tons.

Millions of batteries are scrapped; most of them can not be repaired and resold, but the quantity rehabilitated and sold has been increasing. Some of these rebuilt batteries were sold in 1931 as such and were worth the selling price; many others were worthless and were disposed of by questionable methods. Several articles relating to the composition, quantity, treatment, and disposal of old batteries have been published.[4]

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[4] Schoenbach, Walter, Facts and Figures on Battery Plates: Waste Trade Jour., Jan. 2, 1932, pp. 3 and 6.
Bauer, O. H., Junk Batteries: Nat. Waste Rev., March, 1932, p. 36.
Martin, E. D., Junk and Rebuilt Batteries: Nat. Waste Rev., June, 1932, pp. 18, 19, and 26.

SECONDARY ZINC

Secondary zinc[1] *recovered in the United States, 1930 and 1931, and products made from zinc dross, skimmings, and ashes, in short tons*

	1930	1931
Secondary zinc recovered by redistillation	[2] 34,849	[2] 21,625
Secondary zinc recovered by sweating, remelting, etc	14,451	13,175
Total zinc recovered unalloyed	49,300	34,800
Zinc recovered in alloys other than brass	7,700	7,400
Zinc recovered in brass (estimated)	42,300	30,000
Zinc dust made from zinc dross	6,394	7,478
Zinc dross used for zinc dust (estimated)	7,450	8,700
Zinc concentrates and ore exported		13
Zinc dross exported	1,162	382
Lithopone made from zinc skimmings and ashes	74,034	73,564
Secondary zinc content of lithopone	14,679	15,111
Zinc chloride made from zinc skimmings, ashes, etc	29,697	28,872
Zinc content of zinc chloride made from zinc skimmings, etc	6,532	6,351
Zinc content of zinc sulphate made from zinc skimmings, ashes, etc	784	746

[1] Figures do not include scrap and dross used for lithopone, oxide, zinc dust, or chloride. The use for some of these, especially for zinc chloride, is quite large.

[2] Includes 22 tons of secondary electrolytic zinc in 1930 and 312 tons in 1931.

Secondary zinc recovered as pig metal and in alloys (including brass) decreased 27,100 tons in 1931, largely in redistilled zinc from drosses and in the zinc content of remelted brass.

The total recovery of secondary zinc (including that in brass) in 1931 was equivalent to nearly 25 per cent of the total output of primary zinc in the United States.

Zinc recovered by redistillation decreased from 34,849 tons in 1930 to 21,625 tons in 1931. Of the 1931 total 8,742 tons (a decrease of 6,360 tons) were recovered at retort smelters that treat mainly ore and concentrates, and 12,883 tons (a decrease of 6,864 tons) were recovered by redistillation of zinc drosses at six plants that use large graphite retorts instead of small clay retorts, such as are used by smelters treating zinc concentrates or mixed concentrates and drosses. One electrolytic zinc plant used some zinc residues in 1931.

The six zinc smelters that used large retorts in 1931 were:

Birmingham Smelting & Refining Co., Birmingham, Ala.
Federated Metals Corporation, Trenton, N. J.
General Smelting Co., Philadelphia, Pa.
Nassau Smelting & Refining Co., Tottenville, N. Y.
Superior Zinc Corporation, Philadelphia, Pa.
Wheeling Steel Corporation, Wheeling, W. Va.

Of the total output of 159,516 tons of lithopone in 1931, 73,564 tons—nearly as much as in 1930—were made from zinc skimmings and ashes.

The quantity of zinc chloride made in 1931 was 29,175 tons (a decrease of 544 tons), of which 28,872 tons containing 6,351 tons of zinc were made from zinc residues.

The American Bureau of Metal Statistics estimates that 168,000 short tons of zinc—49,000 tons less than in 1930—were used in 1931 for zincking (galvanizing) sheets, forms, tubes, wire, etc.

SECONDARY TIN

Secondary tin recovered in the United States, 1930 and 1931

	1930	1931
Tin recovered as pig tin.....short tons..	5,600	5,500
Tin recovered in alloys and chemical compounds.....do....	20,600	14,300
	26,200	19,800
Clean tin-plate scrap treated at detinning plants.....long tons..	208,282	180,659
Metallic tin recovered at detinning plants.....pounds..	2,311,035	2,206,219
Tin content of tin tetrachloride, tin bichloride, tin crystals, and tin oxide made at detinning plants.....pounds..	5,173,701	4,282,631
Total tin recovered at detinning plants.....do....	7,484,736	6,488,850
Tin tetrachloride, tin bichloride, tin crystals, and tin oxide made at detinning plants.....pounds..	10,656,966	9,051,189
Average quantity of tin recovered per long ton of clean tin-plate scrap.....do....	35.9	35.9

Tin (metal) and tin concentrates (tin content) imported into the United States, 1930 and 1931, in short tons

	1930	1931
Tin imported as metal.....	90,422	73,992
Tin concentrates (tin content) imported.....	324	34

The domestic primary tin output in the United States in 1931 was only about 4 short tons contained in 6 tons of tin concentrates, whereas the secondary tin recovered was equivalent to nearly 27 per cent of the tin imported into the United States as pig metal.

Secondary tin recovered in 1931 amounted to 19,800 tons, valued at $9,428,800, compared with 26,200 tons, valued at $16,228,300, in 1930. The total value assigned is based on the yearly average price (23.81 cents a pound in 1931) given by the American Metal Market for 99 per cent metal, prompt delivery at New York, a price that was 7.16 cents a pound less than the average in 1930. The total secondary tin recovered decreased 6,400 tons, mainly in tin in alloys. The recovery of tin from scruff and drosses decreased from 4,900 short tons in 1930 to 4,300 tons in 1931.

According to the American Iron and Steel Institute the quantity of tin plate and terneplate made in 1931 was 1,458,943 long tons (304,500 tons less than in 1930). It is estimated that 23,500 long tons of tin were used in these products.

Nearly all detinning in the United States is done by the electrolytic process or by the chlorine process. Many earlier chapters of this series contain data relating to plants and to processes followed, and a complete history of the different methods of detinning is given in an article entitled "Scrap Detinning Affords Big Outlet for Chlorine," by C. L. Mantell, in Chemical and Metallurgical Engineering, August, 1926 (pp. 477–479).

Tin-plate clippings imported in 1931 totaled 7,313 long tons, all from Canada. The average cost of tin-plate clippings delivered at the plants decreased from $9.59 a long ton in 1930 to $6.74 in 1931.

New tin-plate clippings were treated at plants of the Vulcan Detinning Co. at Sewaren, N. J., Neville Island, Pa., and Streator, Ill.; by the Johnson & Jennings Co. of Cleveland, Ohio; and at the plants of the Metal & Thermit Co. at South San Francisco, Calif., East Chicago, Ind., and Chrome, N. J.

The tin reported recovered in alloys and compounds in 1931 included the tin content of products made from clean tin-plate scrap. Most of the tin recovered at the plants listed was in tin bichloride, tin tetrachloride, and tin oxide.

The total recovery of tin as metal or in compounds from clean tin-plate scrap in 1931 was 3,244 short tons, whereas it is estimated that makers of tin plate and terneplate consumed more than 26,000 short tons of tin.

No recoveries were reported from old tin-coated containers, although old cans were collected in Philadelphia and smelted to make sash weights and a plant in Los Angeles collected old cans to make scrap for use in precipitating copper from mine waters. No attempt was made to recover the tin coating at these plants.

A book by C. L. Mantell, of Pratt Institute, Brooklyn, N. Y., Tin: Its Mining, Production, Technology, and Application, includes chapters on the sources of secondary tin and on the various methods of detinning tin-plate scrap.

SECONDARY ANTIMONY

Secondary antimony recovered in and antimony imported into and exported from the United States, 1930 and 1931, in short tons

	1930	1931
Secondary antimony in antimonial lead scrap smelted at regular smelters	1,282	1,474
Secondary antimony recovered at secondary smelters	6,800	6,426
	8,082	7,900
Antimony imported in ore, as metal, or as oxide or salts	10,059	10,099
Foreign antimony exported	493	697

The production of secondary antimony in the United States in 1931, most of which was recovered in alloys, decreased 2 per cent from the recovery reported in 1930. The average price of ordinary brands of antimony, as published by the American Metal Market, was 6.72 cents a pound in 1931, compared with 7.67 cents in 1930. Smelters that ordinarily use primary ores, concentrates, or metals reported 2,438 tons of antimony as contained in 21,842 tons of antimonial lead. The recovery of secondary antimony by secondary smelters decreased about 400 tons in 1931.

The principal materials refined or remelted that contained antimony as an alloy were hard-lead drosses, babbitt, bearing metal, battery plates, pewter, and type metal. The antimony used in the pigment, paint, and ceramic industries is so dissipated that no secondary recoveries can be made, but a large proportion of the production of metal containing antimony returns in a few months or a few years for refining and reuse.

Fewer motor cars were scrapped in 1931, and there was a large decrease in the number of batteries required for new cars.

Most of the old battery plates are collected by dealers and shipped to secondary smelters that buy them at a price based on the price of pig lead at St. Louis. The antimony content is paid for at the price of lead; this price in 1931 was 3.7 cents (3.02 cents less than the average price of ordinary brands of antimony). Several smelters in 1931 smelted batteries and made pig antimony and pig lead instead of antimonial lead, which has only a seasonable sale and a much more limited market.

SECONDARY ALUMINUM

Secondary aluminum recovered in the United States, 1930 and 1931, in short tons

	1930	1931
Secondary aluminum recovered unalloyed	19, 700	15, 200
Aluminum recovered in alloys (mainly No. 12)	18, 900	15, 100
	38, 600	30, 300

Primary aluminum produced in the United States and imported and exported, 1930 and 1931, in pounds

	1930	1931
Primary aluminum produced in the United States	229, 035, 000	177, 544, 000
Aluminum (crude and semicrude) imported for consumption	25, 461, 179	14, 832, 807
Aluminum (crude and semicrude) exported	17, 329, 511	4, 700, 878

The value of primary aluminum produced in the United States decreased from $50,961,000 in 1930 to $37,284,000 in 1931.

The recovery of secondary aluminum (including that in alloys) in 1931 amounted to 30,300 tons, valued at $12,726,000, compared with 38,600 tons, valued at $17,177,000, in 1930.

The use of No. 12 secondary aluminum ingots (92 per cent aluminum and about 8 per cent copper) is extensive, but an increasing quantity of other alloys containing aluminum is being used. The difficulty in sorting and smelting these alloys has forced secondary smelters to adopt more rigid methods of sampling and treatment. The Aluminum Research Institute has formally approved standard methods of sampling and analyzing aluminum and its alloys; these methods were described in a booklet issued in July, 1932. About 85 per cent of the foundries in 1931 consumed remelted aluminum and aluminum alloys, most of which were No. 12 alloy.[5]

The series of articles written by Robert J. Anderson on smelting secondary aluminum and aluminum alloys, listed on page 353 of Secondary Metals in 1930, was continued in the issues of Metal Industry for November and December, 1931. A book [6] issued by Anderson in 1931 should have interest to all producers and consumers of aluminum and aluminum alloys.

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[5] Starmann, G. H., Effect of Temperature on Physical And Casting Properties of No. 12 Aluminum Alloys: Metal Ind., May, 1932, pp. 181–182.

[6] Anderson, R. J., Secondary Aluminum: The Sherwood Press (Inc.), Cleveland, Ohio, 1931, 563 pp.

SECONDARY NICKEL

Secondary nickel recovered in the United States, 1930 and 1931, in short tons

	1930	1931
Nickel recovered as metal	500	270
Nickel recovered in nonferrous alloys and salts	2,400	1,800
	2,900	2,070

Primary nickel produced in the United States and imported and exported, 1930 and 1931, in short tons

	1930	1931
Nickel produced as a by-product from the electrolytic refining of copper at domestic refineries	308	373
Nickel imported for consumption in the United States as nickel or in nickel ores and matte, oxide, and alloys	30,138	17,784
Nickel, Monel metal, and other alloys exported	1,420	888

The nickel reported as recovered from secondary sources includes nickel in Monel metal (the natural alloy) but does not include nickel in ferrous alloys. The practice of using small quantities of nickel in iron and steel, also in brasses and bronzes, has expanded rapidly.

The secondary nickel reported as recovered in 1931 came mainly from scrap-nickel anodes, nickel silver, copper-nickel alloys, and Monel metal. In addition, a large quantity of nickel and alloy containing nickel was purchased on the eastern coast and exported to Europe. The quantity of nickel produced as a by-product from the electrolytic refining of copper was 65 tons more in 1931 than in 1930.

Analyses of various nickel alloys were published in Mineral Resources, 1915.[7]

Considerable information as to the uses of nickel, Monel metal, and other nickel alloys is given in Inco, the publication of the International Nickel Co. This company purchases nickel scrap and Monel scrap.

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[7] Hess, F. L., Nickel: Mineral Resources of the United States, 1915, Pt. I, pp. 763–765.

TIN[1]

By C. W. Merrill[2]

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GENERAL SUMMARY

Tin is by far the most valuable mineral product furnished the United States almost entirely by importation. Imports of tin in 1931 exceeded $36,000,000, but domestic mine production was worth only a little over $2,000. Moreover, the value of the net imports of tin places that commodity seventeenth among domestic imports. Maintenance of a steady flow of tin into the United States is important because tin is indispensable for two of the largest domestic industries—automobile manufacture and canning.

The domestic production of tin in 1931 was 3.7 long tons, valued at $2,050, of which 3.6 tons came from Alaska and the rest from South Dakota. However, recovery of secondary tin—that is, production of tin from sources other than ore—in the United States provides more than one-fifth of the domestic supply of tin.

Summary of statistics for tin in the United States, 1927–1931

	1927	1928	1929	1930	1931
Production long tons	24	42	35	15	3.7
Monthly price of Straits tin in New York:					
Highest cents per pound	69.31	55.64	49.37	38.91	27.07
Lowest do	57.63	47.10	39.79	25.27	21.35
Average do	64.37	50.46	45.19	31.70	24.46
Imports for consumption long tons	71,142	77,970	87,127	80,734	66,064
Exports (domestic and foreign) do	2,239	1,617	1,930	2,233	[1] 1,661
Reclaimed tin do	32,946	31,964	30,625	23,393	17,679

[1] Foreign only. Domestic not separately recorded.

The world production of tin (tin content of ores) in 1931 was 146,000 long tons, a decrease of 16 per cent from the 174,000 tons produced in 1930 and of 24 per cent from the 192,000 tons produced in the record year 1929. In spite of the decrease the output in 1931 exceeded that in 1926 and in any year prior to 1925. The output of the three leading producing countries was 109,762 tons (75 per cent of the world total), as follows: The Federated Malay States produced 51,250 tons (35 per cent); Bolivia, 31,137 tons (21 per cent); and Netherland East Indies, 27,375 tons (19 per cent). The smelter production of tin was even more localized than the mine output, as the three leading tin-smelting countries—Straits Settlements, United Kingdom, and Netherland East Indies—produced approximately nine-tenths of the world total.

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[1] Work on manuscript completed August, 1932.

[2] Figures on imports into and exports from the United States compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The principal supply to consumers in the United States enters the domestic market as imported refined pig tin, and most of it comes from three countries. The Straits Settlements furnished 75 per cent of the 1931 total, the United Kingdom 12 per cent, and Hong Kong 6 per cent. Imports of tin in 1931 totaled 66,064 long tons, a decline of 18 per cent from the 80,734 tons imported in 1930. In value, however, tin imports dropped to a point below that in any year since 1921. The value of tin imports decreased from $104,793,396 in 1926 to $36,723,656 in 1931 (65 per cent). The value in 1931 was 39 per cent less than in 1930. The fall in total value of tin imports resulted not only from a decreased quantity of tin but also from a price decline that has been much greater than the volume decline. The average price for Straits tin at New York was 24.46 cents a pound in 1931 compared with 31.70 cents in 1930 and 65.30 cents in 1926, the year of recent peak price; the 1931 price represents a 23 per cent decrease from 1930 and a 63 per cent decrease from 1926. Although the 1931 average price was lower than that for any year since 1898 it remained well above the low levels that prevailed during much of the nineteenth century.

The world "visible" stocks (in Government warehouses and in transit) rose from 42,498 long tons at the end of December, 1930, to 49,339 at the end of February, 1931. During the remainder of 1931 stocks fluctuated near the 50,000-ton level, reaching a record high point of 51,707 at the close of July and ending the year at 51,313. These large stocks proved a very depressing factor in the tin market. Data concerning changes in stocks held by consumers, merchants, brokers, and others are not available. The activities of the International Tin Pool in connection with visible stocks are discussed on page 333.

The bulk of the tin consumption in the United States depends upon relatively few industries, notably food packing, automobile manufacture, and building. Food packing is relatively stable from year to year and may be counted upon to absorb a fairly constant quantity of tin plate and solder. The automobile industry is subject to wide variation in the number of units produced and the proportion of high-tin-content to low-tin-content cars. The continued recession in the productivity of the automobile industry was the most important factor in the decreased consumption of tin in the United States in 1931. The general depression continued to be felt acutely in the building trades, which are large users of terneplate, tin plate, solder, and a variety of other tin-bearing articles employed in the equipment of new buildings.

The decreased consumption in the United States during 1931 was a very depressing factor on the tin market; nevertheless, much curtailment during 1931 was for needs that ultimately will be supplied. Tin producers can therefore look forward with some degree of optimism, because much business, particularly in the building trades, is not lost but postponed.

Toward the close of 1930 it became apparent that the curtailment program of the Tin Producers' Association would not reduce production in proportion to the decline in consumption. In spite of the association's claims that a 20 per cent curtailment program was in operation, the 1930 world tin output was not 10 per cent below that in 1929. About the time that these facts became generally known a move was started to effect a legally enforceable curtailment program. According to reports,[3] the movement started in England with the Dutch cooperating closely from the first.

The Governments of British Malaya, Bolivia, Netherland East Indies, and Nigeria finally agreed to a production-curtailment plan, but the unexpected length of time required for negotiations made it necessary to postpone initial enforcement from the first of the year until March 1, 1931. The plan assigned an export quota to each of the four signatory countries with the understanding that each would translate this quota into controlled production by assigning output quotas to its respective producers. Each Government, supported by the necessary legislation, issued individual production permits; disregard of these made the offender subject to heavy penalties.

The quotas adopted on March 1, 1931, were found to be too high; consequently, they were reduced on June 1, 1931. Further reductions were introduced on January 1, June 1, and July 1, 1932. The annual quotas on July 1, 1932, were as follows: British Malaya, 23,115 long tons; Bolivia, 14,687 tons; Netherland East Indies, 12,823 tons; and Nigeria, 3,431 tons—54,056 tons in all. Siam joined the quota plan on September 1, 1931, and was assigned a quota of 10,000 long tons not subject to further reductions. The table on page 347 summarizes the quota data.

Another development of the year was the Tin Pool, an international organization for carrying surplus stocks of tin. This organization was formed during August, 1931; it acquired 19,000 long tons of tin before the end of the year. During the early part of 1932 the pool's holdings were increased to 21,000 tons. The original plan called for disposal of the holdings at prices beginning at £150 a long ton and increasing as liquidation proceeded. Suspension of the gold standard by Great Britain in September, 1931, confused the disposal-price program, but it was finally decided to raise the price for the first sales to £165. It has been announced that all the pool's holdings appear in current statistics as "visible" stocks.

The quota plan, which originally provided for withdrawal of participants on six months' notice, has now been extended more or less indefinitely, subject to liquidation of the holdings of the International Pool.

There has been wide difference of opinion as to the wisdom of the production-control program. Proponents of the plan claim that the whole tin industry and future generations will benefit by it because the price will be stabilized and wasteful exploitation of deposits will be avoided. Those opposed to this view hold that the principal objective of the curtailment advocates is to raise the price of tin for the benefit of the producer and at the expense of the consumer. The following quotations are taken from statements by leaders in the two schools of thought. John H. C. E. Howeson, chairman of the Anglo-Oriental Mining Corporation (Ltd.) and of the London Tin Corporation (Ltd.), addressing the annual meeting of the latter company, said:[4]

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[3] American Metal Market, The Rehabilitation of Tin: Vol. 39, No. 19, Jan. 28, 1932, p. 3.

> Although there may still be a few individualistically minded producers who would prefer to be exempted from the scheme (quota plan)—always provided the remainder of the industry is kept rigidly to its quota—there can be none who fails to recognize that, without organized control, tin would by now have shared the plight of rubber. Beyond any doubt the warehouses would have been bursting with more than 100,000 tons of tin; the consumer would only be buying to meet his most immediate requirements, such purchases being effected at whatever price he might choose to pay, and even the lowest of the low-cost producers would certainly be unable to secure for his output a sum sufficient to meet its cost.
>
> And tin, unlike rubber, is a wasting asset. The producer can not under any circumstances—even such as now obtain—be content to deplete his limited reserves and to throw them upon a market which has no use for them, when by producing a little less he will satisfy the needs of the consumer and secure the price he needs. * * *
>
> The producers of tin, whose house—thanks to two years of unremitting effort—is, perhaps, the least disordered among all primary producers, are now ready to lead the way, undismayed by the cost, which is represented by the need of regulating their output to whatever basis consumers may determine. * * *
>
> With a full sense of my responsibility I am bold enough to predict that we have seen the worst as far as tin is concerned, and that with the output completely under control and the industry more solid than ever before the producer may look with certainty in the not far distant future for that compensation to which he is entitled by his courage and the sacrifices he has made in the common cause.

The following paragraphs, supporting the opposition to the control of tin production, are quoted from an editorial in the Metal Bulletin:[5]

> Our hostility to Government and other control of industry is not restricted to tin and is based fundamentally upon economic considerations, fortified by experience of the utter futility of the majority of such attempts. The world to-day is littered with the skeletons of such defunct and moribund monstrosities. * * *
>
> The control schemes for tin started under private auspices with the price in the neighborhood of £230 per ton gold, and they have been no more successful since Government aid was enlisted than when "group" gambling and manipulation had full play. Producers to-day can hardly call their souls their own and are producing less than 50 per cent of what they were in 1929 for less than 50 per cent of the price. Such facts inevitably force themselves upon anyone studying the tin position academically, as we do.
>
> Presumably if production is cut down far enough and if sufficient tin is held off the market for long enough, prices will be forced up; there will remain, however, the aftermath when the control is lifted. Meanwhile, despite Government interference, economic forces must still hold sway and ultimately force the weakest to the wall (which would have happened months ago had matters been left to take their natural course), bringing the industry thus reduced to healthy conditions once more, ready to meet improving circumstances. Under the present arrangement the lifting of Government control may conceivably leave the industry vulnerable and disorganized.

These plans for the so-called stabilization or rationalization of the tin industry have been developed without consulting representatives of the consuming element in the tin industry. Nevertheless there has been little complaint, as the various moves of producers have not arrested the downward trend in the price of tin or reduced the visible stocks to which consumers must look for their immediate needs. The reaction of consumers if tin prices should rise sharply in response to the production-curtailment schemes of the producers remains to be seen.

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[4] American Metal Market, John Howeson Reviews the Tin Situation: Vol. 39, No. 90, May 11, 1932, p. 3.

[5] Metal Bulletin (London), The Control of Industry: No. 1699, June 14, 1932, p. 8.

Aside from the organization of Government forces for the benefit of tin miners the present period is one of consolidation of producers, of diminished prospecting and development, and of less urgent need for replacing tin with substitutes.

DOMESTIC PRODUCTION

Although the United States has never been an important producer of tin it is not without producing deposits; nevertheless, careful studies of areas where tin has been produced or where it has been found, particularly during the World War period, indicate that this country can not expect to supply even an appreciable part of its requirements. The following table gives the domestic mine production for the past 10 years; no smelter production has been reported since 1924.

Tin mined in the United States (including Alaska), 1922–1931, in long tons

[Metallic tin obtainable from concentrates produced in tin mining]

1922–1926 (average)	6	1929	35
1927	24	1930	15
1928	42	1931	3. 7

ALASKA

According to the United States Geological Survey, tin concentrates produced in Alaska in 1931 contained 3.6 long tons of tin compared with 13.1 tons in 1930 and 34.5 tons in 1929. Placers near York on the Seward Peninsula 100 miles north of Nome were the principal producers. Alaska tin concentrates were shipped to Seattle, whence they were exported to the Straits Settlements for smelting.

OTHER STATES

The remaining domestic production was derived from the tin mines of South Dakota. Areas in North Carolina, California, Virginia, South Carolina, and Texas have produced small quantities in the past, and tin minerals are known to occur in many other States.

SECONDARY TIN

During 1931, 17,679 long tons of secondary tin were recovered in the United States, a decline of 24 per cent from that recovered in 1930 and equivalent to 27 per cent of the virgin tin imported in 1931. If the recovery of secondary tin were included with primary production the United States would rank fourth among tin-producing countries. The recovery of secondary tin, as metal, in alloys, and in chemical compounds, in the United States during the past 10 years has been as follows:

Secondary tin recovered as metal and in alloys and chemical compounds in the United States, 1922–1931 [1]

Year	Long tons	Value	Year	Long tons	Value
1922–1926 (average)	25, 959	$29, 299, 700	1929	30, 625	$30, 513, 300
1927	32, 946	46, 302, 100	1930	23, 393	16, 228, 300
1928	31, 964	35, 678, 300	1931	17, 679	9, 428, 800

[1] Figures compiled by J. P. Dunlop, of the Bureau of Mines.

The quantity of secondary tin recovered fluctuates with industrial activity and the price of virgin tin. Depression of both these factors accounts for the decreased amount of tin recovered during 1931. The principal source of secondary tin is the scrap that results from the manufacture of tin-bearing articles, but junk also provides large quantities of secondary tin. The value of this type of scrap and of reclaimed junk depends upon the prices offered for the metals contained. With metal prices at present levels the recovery of tin from much scrap, ordinarily valuable, is unprofitable.

Tin-bearing alloys, tin-plate clippings, and melting-pot drosses are the most important materials from which tin is reclaimed. Most tin recovered from alloys does not pass through a refined-tin stage but is used in making alloys which are brought to the required specifications by adding virgin metals. Virtually all the tin plate entering the reclaiming processes is composed of trimmings incident to the fabrication of tin cans. Some used tin cans have entered the detinning plants, but at the present prices for reclaimed metals the recovery of tin from this source is unprofitable in the United States.

IMPORTS AND EXPORTS

METAL AND ORE

Imported tin concentrates were first smelted in the United States in 1916, following the first imports in 1915. These imports reached the high point in both quantity and value in 1920 and virtually ceased in 1924. The tin content of concentrates imported since 1924 has ranged from 30 long tons in 1931 to 303 tons in 1926. Inability to obtain clean concentrates to mix with refractory Bolivian concentrates was an important factor in ending the United States tin-smelting industry. Another serious disadvantage faced by the domestic industry was the high wage scale compared with that in Great Britain and continental Europe. The export tariff policy of Great Britain continues to make clean concentrates economically unavailable, and its suspension of the gold standard adds to its cost advantage. Nevertheless, the enormous local market, coupled with the proximity of Bolivia, should permit the building up of a large tin-smelting industry in the United States if a process for handling Bolivian concentrates economically, without admixture of clean ore, could be devised. The small quantity of concentrates produced in Alaska is shipped to Seattle, whence it is exported to Straits Settlements for smelting.

Foreign trade of the United States in tin and tin concentrates, 1922–1931

Year	Imports				Exports of metallic tin (long tons)	
	Metallic tin [1]		Tin concentrates [2]			
	Long tons	Value	Tin content (long tons)	Value	Domestic [3]	Foreign [4]
1922–1926 (average)	69,598	$74,151,608	(5)	$1,606,094	602	601
1927	71,142	100,865,205	122	79,089	1,010	1,229
1928	77,970	86,983,174	130	69,227	349	1,268
1929	87,127	91,838,781	128	66,609	790	1,140
1930	80,734	60,233,644	289	177,120	84	2,149
1931	66,064	36,723,656	30	7,117	(6)	1,661

[1] Imports for consumption.
[2] General imports.
[3] Imported as ore and exported as pigs, bars, etc.
[4] Imported as pigs, bars, etc., and exported as such.
[5] Recorded as gross weight of concentrates for 1922 and 1923 and as tin content for 1924–1926.
[6] Not separately recorded.

In 1931, 66,064 long tons of tin (bars, pigs, blocks, grains, and granulated) were imported into the United States compared with 80,734 tons in 1930 and 87,127 tons in 1929. The quantity of tin imported in 1931 was the smallest since 1924, and its value was the lowest since 1921. The Straits Settlements supplied 75 per cent of the tin imported in 1931, the United Kingdom 12 per cent, Hong Kong 6 per cent, the Netherlands 3 per cent, and all others 4 per cent. In 1930 the proportion furnished by the Straits Settlements (69 per cent) was smaller, but the proportions furnished by the United Kingdom (15 per cent) and the Netherlands (9 per cent) were larger; Hong Kong again furnished 6 per cent, and all other countries furnished 1 per cent.

Metallic tin (bars, pigs, blocks, grains, and granulated) imported into the United States, 1930 and 1931, by countries

[General imports]

Country	1930		1931	
	Long tons	Value	Long tons	Value
Australia	236	$143,740	400	$218,624
Canada	6	2,733	32	8,494
China	50	36,117	130	65,938
Dominican Republic	------	------	(1)	71
France	------	------	40	23,080
Germany	86	61,397	851	441,970
Haiti	(1)	72	------	------
Hong Kong	4,905	3,913,161	4,196	2,282,543
Japan	------	------	25	15,850
Malaya (British) (Straits Settlements)	55,739	41,326,304	49,741	27,680,221
Netherlands	7,374	5,844,535	2,008	1,198,402
Netherland East Indies:				
Java and Madura	163	122,504	891	483,363
Other	26	17,354	------	------
United Kingdom	12,149	8,765,727	7,750	4,305,100
	80,734	60,233,644	66,064	36,723,656

[1] Less than 1 ton.

Exports of metallic tin continued small; tin exported in the form in which it was imported decreased from 2,149 long tons in 1930 to 1,661 tons in 1931.

TIN MANUFACTURES

Imports of tin plate, terneplate, and taggers tin amounted to 196 long tons, valued at $42,704, in 1931 compared with 261 tons, valued at $67,102, in 1930. Of the total quantity in 1931, 87 per cent came from the United Kingdom and virtually all the remainder from Canada.

Tin plate, terneplate, and taggers tin imported into the United States, 1930 and 1931, by countries

Country	1930		1931	
	Long tons	Value	Long tons	Value
Canada	69	$18,311	24	$6,129
France	(1)	14	------	------
Germany	(1)	32	1	221
Turkey in Asia	------	------	(1)	15
United Kingdom	192	48,745	171	36,339
	261	67,102	196	42,704

[1] Less than 1 ton.

Exports of tin plate, terneplate, and taggers tin amounted to 84,433 long tons, valued at $7,841,193, in 1931 compared with 216,516 tons, valued at $24,201,977, in 1930, a decrease of 61 per cent in quantity and 68 per cent in value. A great decrease in the world consumption of tin plate has been the principal reason for this unprecedented decline in the United States export trade in tin plate; however, a larger share of the international trade in tin plate was supplied by the United Kingdom and Germany in 1931 than in 1930. The early months of 1932 show further recession in the domestic tin-plate export trade, but for the same period both Great Britain and Germany appear to be expanding their tin-plate exports.

The Anglo-American tin-plate export agreement, which expired in September, 1931, was not renewed in spite of protracted negotiations directed to that end. This agreement allocated the total export market of the United States and the United Kingdom, 30 per cent to the former and 70 per cent to the latter.

Tin plate, terneplate, and taggers tin exported from the United States, 1922–1931

Year	Long tons	Value	Year	Long tons	Value
1922–1926 (average)	154,859	$17,905,201	1929	258,964	$28,566,189
1927	253,888	29,062,466	1930	216,516	24,201,977
1928	249,642	26,345,576	1931	84,433	7,841,193

In quantity, the 1931 exports were less than those in any year since 1922, and their value was less than in any year since 1914. The countries receiving the larger part of the exports in 1931 follow: Japan, $1,610,807; China, $997,962; Mexico, $906,114; Argentina, $724,754; Hong Kong, $476,447; the Philippine Islands, $439,182; Uruguay, $432,485; and Peru, $416,140. Exports to each of these countries decreased, except Peru and Hong Kong, where moderate increases were registered. Canada, which took $6,719,553 worth of United States tin plate in 1930, took only $258,453 worth in 1931; India and Italy also greatly decreased their imports. New York and Maryland were the principal districts in 1931 through which tin plate was exported. Approximately one-half of the total passed through New York and over one-third through the Maryland district. The Buffalo district, through which an important part of the tin-plate exports passed in 1930, had a negligible export in 1931, largely due to the decreased tin-plate exports to Canada.

Tin plate, terneplate, and taggers tin exported from the United States, 1930 and 1931, by countries and by districts

	1930		1931	
	Long tons	Value	Long tons	Value
COUNTRY				
North America:				
Canada	55,780	$6,719,553	2,605	$258,453
Central America—				
Costa Rica	4	538	2	200
Guatemala	2	276	13	1,535
Honduras	1	64	(1)	32
Nicaragua	1	57	1	104
Panama	2	299	1	237
Salvador	18	2,564	6	774
Mexico	11,688	1,249,458	8,873	906,114
Newfoundland and Labrador	99	10,756	126	14,349
West Indies—				
British—				
Jamaica	38	3,947	1	237
Trinidad and Tobago	1	140	12	1,059
Other	3	316	----------	----------
Cuba	4,842	527,914	2,395	255,434
Dominican Republic	11	1,540	5	1,037
Haiti	2	221	(1)	18
Netherland	357	38,491	----------	----------
South America:				
Argentina	14,216	1,445,464	8,715	724,754
Bolivia	----------	----------	5	480
Brazil	2,874	297,499	3,913	320,674
Chile	5,517	584,513	1,633	156,962
Colombia	906	101,334	299	31,250
Ecuador	----------	----------	9	990
Peru	3,545	362,383	4,404	416,140
Uruguay	6,574	676,474	5,022	432,485
Venezuela	336	37,954	74	7,612
Europe:				
Bulgaria	464	51,721	----------	----------
Denmark	28	3,367	77	6,481
France	(1)	49	----------	----------
Greece	1,792	194,492	550	50,134
Italy	7,938	904,971	1,361	124,867
Netherlands	1	180	7	807
Portugal	90	9,570	25	2,632
Soviet Russia	2,294	274,623	3	278
Sweden	29	2,953	538	39,429
United Kingdom	188	18,774	2	322
Yugoslavia	218	24,939	----------	----------
Asia:				
Ceylon	157	16,990	73	7,164
China	17,500	1,870,774	10,563	997,962
East Indies—				
British—				
India	10,660	1,153,831	619	62,021
Malaya (Straits Settlements)	2,282	241,311	1,153	109,582
Netherland—				
Java and Madura	3,046	344,897	1,062	100,804
Other	1,586	164,182	1,515	144,412
Hong Kong	4,102	425,242	4,923	476,447
Japan (including Chosen)	41,040	4,734,122	18,028	1,610,807
Kwantung	846	88,923	425	38,816
Philippine Islands	7,765	833,392	4,433	439,182
Syria	2,873	291,911	157	17,467
Turkey	1,745	184,005	115	10,442
Africa:				
British—Union of South Africa	529	51,580	----------	----------
Egypt	2,269	237,934	667	67,925
Morocco	80	8,932	----------	----------
Portuguese—Mozambique	167	5,238	----------	----------
Oceania (British):				
Australia	9	1,165	23	2,161
New Zealand	1	174	(1)	121
	216,516	24,201,977	84,433	7,841,193
DISTRICT				
Arizona	157	15,976	(1)	53
Buffalo	34,407	4,172,387	1,278	124,911
Chicago	44	5,384	----------	----------
Dakota	5,032	617,611	398	47,065
Duluth and Superior	393	49,661	213	23,219

[1] Less than 1 ton.

Tin plate, terneplate, and taggers tin exported from the United States, 1930 and 1931, by counries and by districts—Continued

	1930		1931	
	Long tons	Value	Long tons	Value
DISTRICT—continued				
El Paso	1	$206	1	$141
Florida	(1)	1		
Los Angeles	23	2,811	111	8,500
Maine and New Hampshire	1	155		
Maryland	71,827	7,700,409	31,502	2,835,369
Michigan	1,456	158,186	166	15,010
Montana-Idaho	17	1,761	18	1,508
New Orleans	189	18,274	22	2,496
New York	75,320	8,316,757	42,955	4,008,311
Ohio	11,969	1,448,145	770	76,871
Oregon	109	12,129		
Philadelphia	9,609	1,019,422	4,377	411,497
Rochester	(1)	12	3	464
St. Lawrence	232	23,700	9	1,222
San Antonio	1,797	198,302	2,013	217,821
San Diego			37	3,058
San Francisco	1,049	110,874	100	11,033
Vermont	1,830	194,333	1	220
Virginia			162	14,894
Washington	1,054	135,481	297	37,530
	216,516	24,201,977	84,433	7,841,193

[1] Less than 1 ton.

Much tin also is exported from the United States in manufactures, little of whose value is derived from the tin they have consumed incident to production. The most important of such exports are products of the automotive and the food-packing industries. There are no statistics on the quantity of tin thus exported, but estimates based on the total exports of these products indicate that it is considerable.

CONSUMPTION

The United States is the world's leading consumer of tin, due largely to its supremacy in the canning and motor-vehicle industries. The Bureau of Mines canvassed the domestic tin-consuming industries to ascertain their annual consumption and stocks of virgin tin in 1927, 1928, and 1930.[6] The results of this work are presented in the following table. As the earlier estimates of the War Industries Board (1917) and the Bureau of Mines (1925)[7] include secondary tin they are not comparable with the following figures.

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[6] Umhau, J. B., Consumption of Primary Tin in the United States during 1930: Inf. Circ. 6564, Bureau of Mines, 1932, 7 pp.

[7] Furness, J. W., Consumption of Tin in the United States, 1925: Inf. Circ. 6019, Bureau of Mines, 1927, 3 pp.

Virgin tin consumed in the United States, 1927, 1928, and 1930, by uses

Use	1927		1928		1930	
	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total
Tin plate and terneplate	24,525	35.96	27,053	36.38	27,753	42.40
Solder	13,602	19.94	13,874	18.66	11,407	17.43
Babbitt	7,595	11.14	8,150	10.96	5,438	8.31
Bronze	4,664	6.84	4,324	5.81	3,499	5.35
Foil	4,193	6.15	5,068	6.81	3,061	4.68
Collapsible tubes	2,710	3.97	2,864	3.85	[1] 3,826	5.84
Chemicals	2,621	3.84	4,246	5.71	3,268	4.99
Tin oxide	1,311	1.92	1,183	1.59	666	1.02
Tinning (brass, copper tubes, sheets, shells, wire, nails, etc.)	2,661	3.90	2,636	3.54	2,814	4.30
White metal	849	1.25	802	1.08	1,117	1.71
Type metal	450	.66	411	.55	223	.34
Castings	1,011	1.48	730	.98	[2] 74	.11
Other alloys	556	.82	629	.85	306	.47
Miscellaneous	1,450	2.13	2,399	3.23	1,996	3.05
	68,198	100.00	74,369	100.00	65,448	100.00

[1] Not comparable with preceding years owing to the canvassing of several additional users whose consumption was not included previously.

[2] Pure tin castings only; in preceding years some tin-alloy castings were reported under this heading.

The consumption of virgin tin can be approximated by calculations based upon production, imports, exports, and stocks. The result is termed "apparent" consumption. Apparent consumption is only an approximation of actual consumption, because it does not take full account of "invisible" stocks and because secondary tin may be included in the figures used for stocks. In the United States, however, the figure for apparent consumption is useful, particularly when it includes an item for consumers' stocks, the chief component of domestic invisible stocks.

Apparent consumption of virgin tin in the United States, 1928–1931, in long tons

	1928	1929	1930	1931
Supply:				
Domestic production	42	35	15	4
Imports of tin as metal	77,970	87,127	80,734	66,064
Imports of tin in concentrates	130	128	289	30
Visible stocks, Jan. 1	1,573	2,428	2,820	4,693
Consumers' stocks, Jan. 1	9,215	8,534	10,606	15,500
Total available	88,930	98,252	94,464	86,291
Withdrawals:				
Exports of tin as metal	1,617	1,930	2,233	[1] 1,661
Exports of tin in concentrates	36	35	15	4
Visible stocks, Dec. 31	2,428	2,820	4,693	6,254
Consumers' stocks, Dec. 31	8,534	10,606	15,500	[2] 15,500
Total withdrawn	12,615	15,391	22,441	23,419
Apparent consumption	76,315	82,861	72,023	62,872
Consumption accounted for in Bureau of Mines canvass	74,369	(3)	65,448	(3)

[1] Foreign exports only for 1931.

[2] 1930 figure repeated in absence of more recent data.

[3] No canvass by Bureau of Mines for 1929 and 1931.

The apparent consumption of virgin tin in the United States amounted to 62,872 long tons in 1931 compared with 72,023 tons in 1930 and 82,861 tons in 1929. The decrease in 1931 (13 per cent from 1930 and 24 per cent from the peak year 1929) was not proportionately reflected by the decline in the several uses of tin. Thus, the tin-plate and solder industries were curtailed much less seriously than the babbitt and foil industries.

The consumption of secondary tin can not be segregated by various uses in as much detail as that of the virgin metal. Much secondary tin is consumed in the form of alloys by companies that are unable to report the exact tin content of the materials they consume. Less than one-fourth of the total secondary tin is recovered as metallic tin before reuse. The principal use of secondary tin is in the manufacture of alloys, and most of it so used is reclaimed from secondary alloys without first being converted into the pure metallic state. The alloy scrap is sorted to remove undesirable elements, is melted and analyzed, and then receives sufficient virgin metals to bring the molten mass to the composition desired. The tin-alloy store of the United States can best be represented as a reservoir, containing many metals, into which a stream of virgin tin must constantly flow to replace losses and provide for expansion.

TIN PLATE AND TERNEPLATE

The tin-plate and terneplate industry is the largest consumer of virgin tin in the United States, having consumed more than one-third of the total virgin tin used in 1927 and in 1928 and having increased its requirements to 42 per cent of the total used in 1930, the last year for which figures are available.

Tin plate is made by coating steel sheets with pure tin, and in present practice standard tin plate contains about 1½ per cent of tin by weight. One pound of tin will make 220 square feet of tin plate. That tin-plate manufacturers are improving the quality of their product by thickening the protective coating, because of the lower price of tin, was confirmed in 1930 by the fact that the consumption of tin for tin plate declined less than the output of tin plate; this trend probably has continued. Terneplate is similar to tin plate, except that an alloy of lead and tin is substituted for pure tin in the coating. Taggers tin is extra-thin tin plate. The larger part of the tin plate and taggers tin manufactured is used for making tin cans, particularly food containers. Terneplate is used largely for roofing and for gasoline tanks on automobiles, and some is substituted for tin plate in nonfood-product containers where the toxic effect of the lead is not deleterious.

In 1931 tin was used in the manufacture of 1,392,227 long tons of tin plate and 66,716 tons of terneplate in the United States compared with 1,660,325 and 103,118 tons, respectively, in 1930. Exports of tin plate, terneplate, and taggers tin amounted to 84,433 long tons in 1931, a decline of 61 per cent from 1930. Imports of tin plate, terneplate, and taggers tin continued negligible. The United States produces approximately twice as much tin plate and terneplate as the United Kingdom but in 1931 exported less than one-fourth as much.

Tin plate and terneplate produced in the United States, 1922–1931, in long tons [1]

Year	Tin plate	Terneplate	Total	Year	Tin plate	Terneplate	Total
1922–1926 (average)	1,433,946	96,756	1,530,702	1929	1,816,223	152,057	1,968,280
1927	1,583,383	105,066	1,688,449	1930	1,660,325	103,118	1,763,443
1928	1,714,990	124,215	1,839,205	1931	1,392,227	66,716	1,458,943

[1] From Annual Report of American Iron and Steel Institute.

AUTOMOBILE MANUFACTURE

The automobile industry consumes a quantity of tin equivalent to almost one-eighth of that imported. According to the National Automobile Chamber of Commerce,[8] 8,000 long tons of tin were consumed by this industry in 1931 compared with 11,000 tons in 1930 and 21,000 tons in 1929. The number of motor vehicles produced in 1931 was the lowest since 1921 and a 55 per cent decline from the record year 1929. An even lower production is expected for 1932. The chief uses of tin in automobile manufacture are in babbitt for engine bearings, solder for radiators, and bronzes for bearings and bushings.

The number of motor vehicles registered in 1931, which for the first time in automobile history was less than that for the preceding year, was 11 times the number of new units manufactured; their maintenance and repair constitute a substantial factor in the consumption of tin.

Production, registration, and exports of motor vehicles in the United States, 1922–1931

Year	Production [1]			Registration [2] (all classes)	Exports [3] (all classes)
	Passenger cars	Trucks and busses	Total		
1922–1926 (average)	[4] 3,320,788	428,710	3,749,498	[5] 17,529,000	203,442
1927	2,936,533	464,793	3,401,326	23,254,000	384,195
1928	3,815,417	543,342	4,358,759	24,611,000	507,097
1929	4,587,400	771,020	5,358,420	26,616,000	536,207
1930	2,784,745	571,241	3,355,986	26,632,000	237,582
1931	1,973,090	416,640	2,389,730	25,915,000	130,705

[1] Bureau of the Census.
[2] Bureau of Public Roads.
[3] Bureau of Foreign and Domestic Commerce.
[4] Taxicabs not included prior to 1924.
[5] Road tractors not included prior to 1924.

OTHER MANUFACTURES

Smaller but increasingly important users of tin and its alloys are the manufacturers of airplanes, motor ships, and stationary Diesel engines. All these products require tin in their manufacture for much the same purposes as do automobiles. The rapidly increasing manufacture of electric refrigerators should prove an outlet of growing importance for tin, as these utilize heavily tinned racks and trays as well as much tin in the refrigerating units.

SUBSTITUTES

A few years ago, when the price of tin was more than double what it averaged during 1931, the opinion was widely expressed that the reserves of tin, marketable at the prices then current, were very limited. Intensive research for substitutes resulted. The field for making important substitutions seemed very promising, because at that time tin was the highest-priced metal in the common base-metal group. Since then the fall in the price of tin and the growing tin stocks have refuted the opinion that tin reserves are now very limited; in consequence, the search for substitutes has diminished. Nevertheless, many of those concerned with the supply of tin in the more distant future can not escape the opinion that adequate supplies may require payment of prices much higher than those now current. Moreover, domestic consumers must depend upon substitutes as one of their most effective means for maintaining reasonable tin prices as well as one of their principal means for continued production if war should curtail the flow of tin to the United States.

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[8] National Automobile Chamber of Commerce, Facts and Figures of the Automobile Industry: New York, ed. 1930, 1931, and 1932—p. 83 (1930 ed.), p. 83 (1931 ed.), and p. 51 (1932 ed.).

The finding of a substitute for tin plate in the canning industry has been studied in detail but to date no tin-free container has been developed that can compete seriously with the tin can. Glass containers have been used successfully where the advantage of display of contents has outweighed higher initial cost and difficulties of transportation. Research to develop a practical aluminum can continues. So far the aluminum products have not only been costly but have failed to withstand the rough handling to which the ordinary can is subjected.

Aluminum is being substituted for tin in the manufacture of foils and collapsible tubes and is invading the fields where lead is excluded because of its toxic properties. Because of its low specific gravity a given weight of aluminum will make much more foil of a given gage than an equal weight of tin, but this advantage is offset in some tin foils by rolling from bars containing a lead core. Zinc foil displaced some tin foil during 1931. Zinc has been suggested as a substitute for tin in some foil making ever since commercial grades of zinc first approximated chemical purity. Only in 1931, however, was the first large-scale zinc-foil production reported. It is understood that results did not indicate any great probability of extensive substitution of zinc for tin in foils at current prices for the metals. Tin foil is also meeting severe competition as a food and cigar wrapper in "cellophane," a transparent cellulose product, and in various waxed papers.

PRICES[9] AND STOCKS

The break in the tin market that started in April, 1927, continued with only minor recoveries until a low monthly average of 21.35 cents a pound was reached in December, 1931; thus, the average monthly price recorded for December, 1931, represented a decline of 70 per cent from the high monthly average of 70.67 cents recorded for November, 1926. The price record of tin in 1931 includes a high monthly average of 27.07 cents for March, a low monthly average of 21.35 cents for December, and an average of 24.46 cents for the year, compared with the 1930 record of a high average monthly price of 38.91 cents for January, a low of 25.27 cents for December, and an average of 31.70 cents for the year. The average price for 1931 was thus 7.24 cents (23 per cent) less than that for 1930. The average price for December, 1931, was 3.92 cents (16 per cent) below that for the closing month of 1930.

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[9] Prices used in this discussion refer to Straits tin at New York, as quoted in the American Metal Market and published in Metal Statistics, 1932, pp. 311 and 313.

Monthly price of Straits tin for prompt delivery in New York, 1929–1931, in cents per pound [1]

	1929			1930			1931		
	High	Low	Average	High	Low	Average	High	Low	Average
January	49.87½	48.50	49.16	39.75	37.80	38.91	27.25	25.40	26.10
February	50.37½	48.80	49.37	39.20	37.75	38.67	27.20	25.25	26.31
March	49.62½	48.37½	48.85	37.90	35.85	36.81	27.50	26.50	27.07
April	48.75	43.75	45.97	37.20	34.00	36.07	26.62½	23.35	25.12
May	44.62½	43.37½	43.92	33.25	31.25	32.13	24.15	22.50	23.20
June	44.75	43.50	44.26	31.12½	29.50	30.30	26.00	22.30	23.41
July	47.50	44.70	46.40	30.37½	29.15	29.81	26.75	24.12½	25.02
August	47.37½	46.12½	46.65	30.35	29.60	30.02	27.15	24.30	25.75
September	45.87½	45.00	45.38	30.00	28.70	29.64	26.75	22.25	24.68
October	44.25	40.37½	42.35	28.00	24.75	26.86	23.37½	22.12½	22.76
November	41.87½	39.12½	40.22	26.75	25.20	25.89	23.55	21.40	22.80
December	41.75	38.37½	39.79	26.87½	23.75	25.27	21.95	20.60	21.35
Year	50.37½	38.37½	45.19	39.75	23.75	31.70	27.50	20.60	24.46

[1] Metal Statistics, 1932, pp. 311 and 313.

Unlike copper, zinc, and silver, tin did not establish a new low price in 1931. Nevertheless, the 1931 average price is the lowest since 1898. During the decade ended in 1898, however, the average price of tin for no year exceeded that for 1931. The early months of 1932 have brought no improvement in the price of tin.

Prices of tin plate and sheet bars at Pittsburgh and pig tin at New York on dates of principal price changes of tin plate, 1926–1931 [1]

Date	Tin plate (per base box)	Sheet bars (per long ton)	Pig tin (per pound)
			Cents
1926: Nov. 9	$5.50	$36.00	71.00
1927: Nov. 30	5.25	34.00	58.62½
1928: Nov. 15	5.35	34.00	50.12½
1929: Dec. 31	$5.25	$34.00	39.75
1930: Oct. 1	5.00	31.00	28.00
1931: Oct. 1	4.75	29.00	22.12½

[1] Metal Statistics, 1932, p. 129.

The monthly average of the world "visible supply" of tin has been as follows: 1928, 18,392 long tons; 1929, 25,481 tons; 1930, 38,621 tons; and 1931, 49,900 tons. The supply followed a fairly regular downward trend from the high yearly average of 24,682 tons for 1922 to the low monthly average of 13,352 tons for August, 1926. Stocks remained at approximately this figure until April, 1928, when, except for a drop in June, there was a steady increase to the end of the year. Stocks remained relatively constant from then until December, 1929. A second period of increasing stocks began in December, 1929, and continued until June, 1930, when the total reached 42,611 tons, a level that was maintained until February, 1931, when stocks reached 49,339 tons. During the rest of the year visible stocks remained near 50,000 tons, attaining an all-time high of 51,707 tons at the end of July and closing the year with 51,313 tons for December. The early months of 1932 show maintenance of this high level. These large and increasing stocks of tin have been a major factor in depressing the price of tin.

Visible stocks of tin in the world and in the United States at end of each month, 1922–1931, in long tons [1]

Month	1922–1926 (average)		1927		1928		1929		1930		1931	
	World	U. S.	World	U. S.	World	U. S.	World	U. S.	World	U. S.	World	U. S.
January	23, 570	2, 799	15, 342	3, 304	15, 244	2, 518	24, 237	2, 611	29, 032	3, 081	43, 619	4, 904
February	22, 530	2, 822	14, 221	2, 484	17, 645	1, 998	26, 402	3, 307	33, 581	3, 626	49, 339	5, 862
March	20, 992	3, 327	15, 441	1, 709	15, 586	2, 078	26, 632	2, 550	32, 972	3, 566	48, 607	7, 917
April	19, 735	2, 858	13, 849	1, 704	15, 001	1, 973	26, 353	3, 603	36, 595	5, 687	48, 462	6, 212
May	21, 197	2, 453	14, 655	1, 604	17, 064	3, 708	24, 765	3, 464	39, 771	6, 767	51, 231	5, 698
June	20, 220	2, 585	15, 638	1, 519	16, 231	2, 148	23, 751	3, 830	42, 611	7, 728	51, 626	5, 633
July	19, 437	3, 015	15, 377	1, 984	18, 022	2, 878	23, 789	3, 087	41, 950	6, 786	51, 707	5, 838
August	19, 730	2, 924	14, 487	2, 201	18, 456	1, 718	26, 400	2, 858	43, 805	7, 533	50, 987	6, 213
September	19, 020	2, 347	15, 083	1, 973	19, 924	3, 508	24, 556	2, 479	40, 150	6, 323	50, 722	5, 868
October	18, 735	2, 595	14, 684	3, 158	20, 907	4, 598	25, 580	2, 720	39, 676	4, 823	50, 602	6, 773
November	19, 983	2, 014	14, 594	2, 003	22, 067	3, 603	25, 171	2, 050	40, 811	5, 372	50, 583	7, 458
December	21, 090	2, 553	15, 733	1, 573	24, 563	2, 428	28, 140	2, 820	42, 498	4, 693	51, 313	6, 254
Average	20, 520	2, 691	14, 925	2, 101	18, 392	2, 763	25, 481	2, 947	38, 621	5, 499	49, 900	6, 219

[1] Metal Statistics, 1932, pp. 303 and 304.

Visible stocks of tin held in the United States averaged approximately 2,500 tons for many years, seldom dropping below 1,500 tons and seldom exceeding 5,000 tons, but in 1930 and 1931 there was a sharp increase in stocks held. In 1931 stocks at the close of the month recorded a high point of 7,917 tons in March and a low of 4,904 tons in January; the average for the year was 6,219 tons. This supply, however, would have satisfied the requirements of domestic industry for less than six weeks had all other sources been cut off. The lower price of tin and the increasing activity in the National Metal Exchange probably are the principal factors accounting for the increased domestic tin stocks.

The so-called invisible stocks of tin are exceedingly difficult to estimate, as they consist largely of stocks held by consuming manufacturing companies and by metal merchants and speculators. The questionnaires that have formed the basis of the Bureau of Mines studies of tin consumption since 1928 indicate that manufacturing requirements rather than current price of the metal determine the stocks carried by consumers of virgin tin in the United States. Nevertheless, it may be noted that stocks held by consumers increased by almost one-half during 1930. At the end of 1930 consumers had enough tin to last two and one-half months at the average rate of consumption prevailing during 1930.

WORLD PRODUCTION AND RESOURCES

The world production of tin in 1931 was 146,000 long tons compared with 174,000 tons in 1930, 192,000 tons in 1929, and 177,000 tons in 1928. The production in 1931 was 16 per cent less than that in 1930 but was greater than that in 1926 and in any year prior to 1925. The Bureau of Mines has made available during the year a detailed record[10] of tin production since the beginning of the nineteenth century. The annual increase in production brought out in this study, although at a geometrical rate, indicates that the output of tin has expanded more slowly than any other important common metal except silver. Thus, if the future may be judged by the past the production of tin probably will resume its slow expansion as soon as the present dislocation of industry and trade is overcome.

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[10] Umhau, J. B., Summarized Data of Tin Production: Econ. Paper 13, Bureau of Mines, 1932, 34 pp.

World production of tin (content of ore), 1922–1931, by countries, in long tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1922–1926 (average)	1927	1928	1929	1930	1931
Australia	2,960	3,144	2,890	2,239	1,451	1,750
Belgian Congo	1,017	873	785	971	652	(1)
Bolivia[2]	31,053	35,808	41,409	46,343	38,161	31,137
China[2]	7,871	6,220	7,033	6,778	6,483	6,000
England	1,609	2,593	2,761	3,271	2,488	597
India (British)	1,670	2,447	1,946	2,649	2,990	2,700
Indo-China	(1)	699	796	829	992	874
Malay States:						
Federated[2]	41,770	52,180	61,935	67,042	62,065	51,250
Unfederated	1,919	2,105	2,680	2,326	1,699	1,365
Mexico	(1)	----------	(1)	(1)	(1)	761
Netherland East Indies	30,215	33,328	34,837	35,236	34,590	27,375
Nigeria	6,171	8,056	9,132	10,734	8,331	7,556
Portugal	(1)	695	678	(1)	(1)	(1)
Siam	7,206	7,584	7,572	10,517	11,526	[2] 12,497
Union of South Africa	964	1,147	1,249	1,218	930	(1)
Other countries[3]	1,700	900	1,100	1,500	1,900	1,900
	136,000	158,000	177,000	192,000	174,000	146,000

(1) Less than 500 tons; included under "Other countries."

[2] Exports.

[3] Includes countries producing less than 500 tons.

Reduction in the output of tin in 1931 is noted for all countries producing over 500 tons except Siam, Australia, and Mexico; Siam alone of the three is an important factor in the tin-mining industry. The major part of the reduction in output resulted from enforced curtailment of production in the Federated Malay States, Bolivia, Netherland East Indies, and Nigeria, whose Governments originated the legally enforced production-curtailment program. The decline in production in England (76 per cent) should also be noted; this reduction resulted entirely from the voluntary closing of unprofitable mining operations.

Tin-production quotas (annual) for countries signatory to the tin-production curtailment plan, in long tons

Country	Production (1929)		Quota				
	Reported by Bureau of Mines	Agreed upon as quota basis	1931		1932		
			Mar. 1	June 1	Jan. 1	June 1	July 1
British Malaya	69,371	69,366	53,928	45,375	38,960	30,406	23,115
Bolivia	46,343	92,480	34,260	28,826	24,751	19,317	14,687
Netherland East Indies	35,236		29,916	25,171	21,612	16,867	12,823
Nigeria	10,734		7,992	6,724	5,773	4,506	3,431
Siam	10,517	24,672	(1)	[2] 10,000	10,000	10,000	10,000
Other countries	19,452		(1)	(1)	(1)	(1)	(1)
Total production	192,000	186,518	----------	----------	----------	----------	----------
Reduction	----------	----------	36,000	20,000	15,000	20,000	17,040
Cumulative reduction	----------	----------	36,000	56,000	71,000	91,000	108,040

(1) No restriction of output.

[2] Not effective until Sept. 1, 1931.

British Malaya.—The southern part of the Malay Peninsula, known as British Malaya, comprises three major political divisions—the Federated Malay States, the Straits Settlements, and the Unfederated Malay States.

The Federated Malay States, the world's leading source of tin ore, produced concentrates containing 51,250 long tons of metallic tin in 1931 compared with 62,065 tons in 1930 and 67,042 tons in the record year 1929. The legally enforced curtailment program was the principal factor in the reduction of output. Of the 119 dredges in use 63 were temporarily idle at the end of 1931. The proportion of production from European-owned mines and from dredges increased at the expense of that from Chinese-owned mines and from other methods, respectively.

The Straits Settlements is the world's leading producer of smelted tin. In 1931 its output decreased 14 per cent because of smaller mine production in the countries supplying the bulk of tin concentrates to smelters.

The Unfederated Malay States together produced concentrates containing 1,365 long tons of metallic tin in 1931 compared with 1,699 tons in 1930 and 2,326 tons in 1929.

Bolivia.—Bolivia, the second largest producer of tin and largest producer of lode tin, exported concentrates and ore containing 31,137 long tons of tin in 1931 compared with 38,161 tons in 1930 and 46,343 tons in 1929. The Patiño Mines & Enterprises Consolidated (Inc.), which produced almost one-half of Bolivia's tin in 1931, increased its importance in the Bolivian tin industry by acquiring the Sociedad Empresa de Estaño de Araca, a company having large reserves and producing over 1,000 tons of tin a year.

Netherland East Indies.—The Netherland East Indies produced concentrates containing 27,375 long tons of tin in 1931 compared with 34,590 tons in 1930 and 35,236 tons in 1929. Part of the concentrates were smelted locally, and the remainder were exported to the Straits Settlements for reduction. As in the past, virtually all the production came from mines operated by the Government, the Billiton Mining Co., and the Singkep Tin Co.

Siam.—Siam produced concentrates containing 12,497 long tons of tin in 1931 compared with 11,526 tons in 1930 and 10,517 tons in 1929. Thus, Siam was the only important tin producer that has had an annually increasing tin output in recent years. Siam had 38 tin dredges at the close of 1931, from which 57 per cent of the country's output of tin was obtained.

Nigeria.—Nigeria produced concentrates containing 7,556 long tons of tin in 1931 compared with 8,331 tons in 1930 and 10,734 tons in 1929; all the concentrates were exported for smelting. The Anglo-Oriental Mining Corporation (Ltd.) working through its associated companies, the London Tin Corporation (Ltd.) and the Associated Tin Mines of Nigeria (Ltd.), has brought under its control almost one-half of the Nigerian tin production.

China.—Shipments from China in 1931 were reported as 6,000 long tons of tin compared with 6,483 tons in 1930 and 6,778 tons in 1929.

United Kingdom.—The production of tin (content of domestic ores) in the United Kingdom was 597 long tons in 1931 compared with 2,488 tons in 1930 and 3,271 tons in 1929. The importance of the United Kingdom in tin production, however, is based upon the output of its smelters at Liverpool and Redruth. The principal tin smelters of the United Kingdom were brought under one management through the formation of Consolidated Tin Smelters (Ltd.) at the close of 1929.

Other countries.—The countries separately discussed accounted for 138,000 long tons (95 per cent of the total production) in 1931. The remaining 8,000 tons were produced largely by India, Australia, Indo-China, and Mexico; but a rise in the price of tin undoubtedly would increase activity in the Union of South Africa, the Belgian Congo, Tanganyika, Uganda, South-West Africa, Swaziland, Gold Coast, French Morocco, Portuguese East Africa, Rhodesia, Spain, Portugal, Russia, Japan, Argentina, and Canada.

LEAD [1]

By E. W. Pehrson [2]

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GENERAL SUMMARY

Salient figures of the lead industry in the United States, 1930 and 1931

	1930	1931
Production of refined primary lead:		
From domestic ores ... short tons	573, 740	390, 260
From foreign ores and base bullion ... do	69, 293	52, 504
	643, 033	442, 764
Recovery of secondary lead:		
As pig lead ... do	129, 000	128, 800
In alloys ... do	126, 800	105, 900
	255, 800	234, 700
Total production of pig lead (primary and secondary) ... do	772, 033	571, 564
Imports (general):		
Lead in base bullion ... do	38, 630	32, 320
Lead in ore ... do	39, 377	20, 888
Exports of refined pig lead ... do	48, 307	21, 665
Refined primary lead available for consumption ... do	582, 774	410, 606
Estimated consumption of primary and secondary lead ... do	768, 600	567, 700
Prices per pound of refined lead at New York:		
Highest monthly average ... cents	6. 25	4. 80
Lowest monthly average ... do	5. 10	3. 79
Average for year ... do	5. 52	4. 24
Quotation at end of year ... do	5. 10	3. 75
Mine production of recoverable lead ... short tons	558, 313	404, 622
Southeastern Missouri district ... per cent of total	36	39
Utah ... do	21	20
Coeur d'Alene region ... do	23	24
Joplin (tri-State) region ... do	7	5
All other ... do	13	12
World smelter production of lead ... short tons	1, 843, 000	1, 555, 000
United States ... per cent of total	33	27
Mexico ... do	13	16
Australia ... do	10	11
Canada ... do	8	9
Spain ... do	7	8
All other ... do	29	29

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[1] Work on manuscript completed October, 1932.

[2] Statistics prepared (unless otherwise indicated) by H. M. Meyer and data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

The unfavorable condition of the lead industry in 1930 was intensified in 1931 by further decline in industrial activity. Again, as in 1930, producers failed to adjust production to steadily declining consumption; in consequence, stocks increased and prices fell.

In the United States the production of refined primary lead from domestic ores decreased 32 per cent and that from foreign ores and base bullion 24 per cent, making a decrease of 31 per cent in total primary output. Total production in 1931 was 45 per cent below that in 1926 (the year of peak production) and 1 per cent below the 1921 output. Production fell rapidly during the first six months of the year but during the latter half it was relatively stable.

The New York quotation declined from a high of 5.10 cents per pound at the beginning of the year to 3.75 cents at the end of May. Announcement of the debt moratorium during the latter part of June caused an upward movement which brought the quotation to 4.40 cents, where it remained throughout July, August, and September. In October the downward trend was resumed, and at the close of the year the price was again 3.75 cents. The average for the year was 4.24 cents, a decrease of 23 per cent from 1930 and the lowest yearly average since 1914; it was less than half the record average of 9.02 cents in 1925. From January to December, 1931, the average monthly price of lead decreased 21 per cent, whereas the general price level declined only 12 per cent.

The recovery of secondary lead in pig lead and alloys declined only 8 per cent in 1931 and was equivalent to 60 per cent of the domestic production of refined primary lead. This ratio exceeded the previous high of 49 per cent in 1928 and emphasizes the importance of secondary lead in our domestic lead supply.

The consumption of lead in the United States in 1931, as estimated by the American Bureau of Metal Statistics, declined 26 per cent from 1930 and 42 per cent from 1929, the year of record consumption. Among the principal consuming industries, cable covering and building showed the greatest declines, whereas storage batteries, white lead, and ammunition were fairly well maintained. Storage batteries, in which the use of lead declined only 4 per cent in 1931, again became the principal outlet for lead, replacing cable coverings which declined 44 per cent. White lead was third in importance with a decline of 8 per cent; building ranked fourth and ammunition fifth. Building and ammunition declined 40 and 11 per cent, respectively.

According to the American Bureau of Metal Statistics, stocks of refined pig lead and antimonial lead at smelters and refineries in the United States increased from about 103,000 tons on January 1 to about 151,000 tons on December 31, 1931. At the beginning of 1930 stocks amounted to 51,000 tons.

General imports of lead in base bullion decreased 16 per cent; imports from Mexico increased 58 per cent, but those from Peru decreased over 99 per cent. Receipts of lead in ore and matte declined 47 per cent. Very large decreases in shipments from Canada and Mexico were partly offset by increased imports from Newfoundland. Exports of refined pig lead declined 55 per cent and were the lowest since 1920.

Mine production of lead decreased 28 per cent in 1931 and was the lowest since 1910. Missouri, Idaho, and Utah contributed 84 per cent of the total but decreased 20, 26, and 31 per cent, respectively. Oklahoma, which again ranked fourth, declined 43 per cent; and Colorado, which ranked fifth in 1930, fell to eighth in 1931 due to a decline of 69 per cent in output.

World smelter production of lead amounted to 1,555,000 short tons, 16 per cent less than in 1930 and the lowest yearly output since 1924. The United States share of the total was 27 per cent in 1931 compared with 33 per cent in 1930 and 38 per cent during the 5-year period 1925 to 1929. Smelter production in the United States declined 32 per cent in 1931, whereas production elsewhere declined only 7 per cent. Mexico showed a slight increase in production, whereas Australia, Canada, Spain, Germany, Belgium, and India showed declines ranging from 6 to 11 per cent.

The London price of lead in 1931 averaged £13.029 per long ton, the lowest yearly average since 1910. In terms of gold, the 1931 price was equivalent to 2.64 cents per pound, 33 per cent below the 1930 average and the lowest since 1904. The London average in 1931, as in 1930, was 1.60 cents below the New York average; in 1929 the differential was 1.79 cents per pound.

According to press reports, effective May 1, 1931, the European lead cartel agreed to a 15 per cent curtailment program based on 1930 production; on July 1 it was increased to 20 per cent.

During 1931 the decline in the foreign exchange rates on Mexican, Australian, and Spanish currencies aided in maintaining production in those countries. In spite of low prices large-scale lead production began at Mount Isa in June. A new plant in England capable of refining 6,000 tons of Mount Isa lead bullion per month began production during the latter part of the year. Construction of additional milling capacity was under way during 1931 at the Buchans mine, Newfoundland, and at the Stantrg mine, Yugoslavia.

PRODUCTION

GENERAL

Pig lead produced in the United States for domestic market and export is derived from three main sources—domestic ore, foreign ore and base bullion, and secondary materials.

The following table shows the quantity of pig lead produced from each of these sources from 1927 to 1931.

Pig lead produced in the United States, 1927–1931, in short tons

Year	From domestic ores and base bullion	From foreign ores and base bullion	From secondary materials	Total
1927	668,320	128,210	119,000	915,530
1928	626,202	154,869	138,000	919,071
1929	672,498	102,135	138,500	913,133
1930	573,740	69,293	129,000	772,033
1931	390,260	52,504	128,800	571,564

The total production of pig lead in the United States in 1931 declined 26 per cent from that in 1930 and was 38 per cent below that in 1926 (the year of peak production), but exceeded the 1921 output by 15 per cent. Production from domestic ores and base bullion decreased 32 per cent and from foreign ores and base bullion 24 per cent, whereas that from secondary materials decreased less than 1 per cent.

PRIMARY LEAD

REFINERY PRODUCTION

Pig lead is classified by the Bureau of Mines as primary or secondary, according to whether it is derived directly from the smelting of ores and from base bullion or is reclaimed from junk and industrial lead scrap. Details of the Bureau of Mines classification of pig lead were given in the 1930 chapter of this series.

The following table summarizes the refined primary lead produced in the United States from 1720 to 1931.

Refined primary lead produced in the United States, 1720–1931

Year	Short tons							Value		
	Desilverized lead [1] [2]	Desilverized soft lead	Soft lead [2]	Total production [1]	From domestic ores and base bullion	From foreign ores	From foreign base bullion	Average per pound	Domestic	Total
1720-1900	[3] 3,675,591	[3] 75,882	1,691,820	5,443,293	4,620,756	822,537		$0.043	$408,662,000	$471,998,000
1901-1910	2,895,684	185,653	940,165	4,021,502	3,140,115	881,387		.046	287,468,000	366,494,000
1911-1920	3,214,732	488,932	1,652,821	5,356,485	4,758,075	106,140	492,270	.059	563,002,000	632,432,000
1921-1925	1,734,583	300,765	1,021,687	3,057,035	2,632,137	138,715	286,183	.070	368,121,000	429,463,000
1926	484,669	55,707	258,565	798,941	680,685	48,210	70,046	.080	108,910,000	127,831,000
1927	507,099	55,487	233,944	796,530	668,320	32,369	95,841	.063	84,208,000	100,363,000
1928	506,603	49,465	225,003	781,071	626,202	26,632	128,237	.058	72,639,000	90,604,000
1929	483,622	55,666	235,345	774,633	672,498	29,675	72,460	.063	84,735,000	97,604,000
1930	396,094	45,578	201,361	643,033	573,740	34,348	34,945	.050	57,374,000	64,303,000
1931	263,919	40,456	138,389	442,764	390,260	22,254	30,250	.037	28,879,000	32,765,000
	14,162,596	1,353,591	6,599,100	22,115,287	18,762,788	3,352,499		.055	2,063,998,000	2,413,857,000

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[1] The lead content of antimonial lead is excluded (see p. 357).

[2] Desilverized soft lead is excluded.

[3] Desilverized soft lead is included under "Desilverized lead" prior to 1894. Separate figures not available.

The total production of refined primary lead in the United States in 1931 was 31 per cent less than in 1930, 45 per cent below 1926 (the year of peak production), and the lowest yearly output since 1908. The total value of the output in 1931 declined 49 per cent from 1930 and 75 per cent from the record value in 1925 and was the lowest since 1903. Curtailment was more pronounced in lead produced from domestic sources, which contributed 88 per cent of the total primary lead in 1931, compared with 89 per cent in 1930. The production of refined lead from domestic ores decreased 32 per cent in 1931, amounted to only 57 per cent of the record domestic output in 1926, and was the lowest since 1910; however, it was only 2 per cent below the 1921 output. Lead derived from the smelting of foreign ores declined 35 per cent and amounted to 5 per cent of the total, whereas lead derived from the refining of foreign base bullion decreased only 13 per cent and was 7 per cent of the total.

GEOGRAPHICAL SOURCE OF LEAD RAW MATERIALS SMELTED OR REFINED IN THE UNITED STATES

The following table shows the source of the ore and foreign base bullion from which refined lead was produced in the United States from 1929 to 1931. Much of the base bullion produced in the Western States is shipped to the Mississippi Valley and Eastern States for refining. In reporting the production of lead by sources most refiners make the distribution on the basis of base bullion, so that the total lead given in this table as from domestic ore includes both base bullion and refined lead and thus contains a large part of the antimonial lead produced from domestic ores. The domestic total given here for 1931 exceeds by 3,339 tons the total production of refined lead from domestic ores shown in the preceding table. In 1931 antimonial lead produced in the United States contained 3,628 tons of lead derived from domestic ores.

Primary lead smelted or refined in the United States, 1929–1931, by sources, in short tons

Source of ore	1929	1930	1931
Domestic ore:			
Alaska	1,266	1,320	1,607
Arizona	8,153	4,223	2,085
Arkansas [1]	----------	41	21
California	1,459	1,848	1,893
Colorado	23,675	25,091	6,311
Idaho	147,595	135,411	100,970
Illinois [1]	777	268	162
Kansas [1]	[2] 26,104	[2] 13,103	[2] 6,601
Kentucky [1]	303	87	----------
Missouri [1]	211,345	201,056	151,359
Montana	26,795	15,412	4,766
Nevada	13,256	14,091	8,348
New Mexico	12,249	11,250	11,045
New York [1]	----------	(3)	(3)
Oklahoma [1]	[2] 45,653	[2] 23,398	[2] 12,312
Oregon	15	7	3
Texas	559	240	6
Utah	157,085	122,311	75,207
Virginia [1]	(3)	(3)	(3)
Washington	447	577	1,314
Wisconsin [1]	1,729	1,832	740
Domestic ore—Con.			
Undistributed	5,624	7,452	8,132
Zinc residues	1,903	995	717
	685,992	580,013	393,599
Foreign ore:			
Australia	5	3	----------
Canada	9,499	14,369	3,816
Europe	28	41	43
Mexico	16,807	14,949	6,420
South America	3,285	3,476	2,299
Other foreign	51	1,510	9,676
Foreign base bullion:			
Mexico	51,295	18,592	30,072
South America	21,165	16,353	178
	102,135	69,293	52,504
Grand total	788,127	649,306	446,103

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[1] The lead produced by these States is nonargentiferous or soft lead. A small quantity of the lead produced from Colorado and New Mexico ores is also nonargentiferous.

[2] The smelter output of lead in Kansas and Oklahoma is separated on the basis of mine output as the Bureau of Mines has been unable to obtain an accurate separation of smelter output.

[3] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

The foregoing table shows large decreases in lead production in 1931 in most of the important lead-producing States. Foreign ore smelted in the United States came largely from Newfoundland (included under "Other foreign"), Mexico, Canada, and South America (chiefly Bolivia); all but Newfoundland showed large decreases. Refined lead produced from Mexican base bullion increased 62 per cent, whereas that from South American base bullion decreased 99 per cent as a result of cessation of shipments from Peru.

SPECIFICATIONS FOR PIG LEAD

The American Society for Testing Materials classifies pig lead in three grades—corroding, chemical, and common. The requirements as to chemical composition of each of these grades were shown in the 1930 chapter of this series.

SOFT LEAD

Nonargentiferous lead ores of high purity, from which a soft lead can be produced without elaborate refining processes, are known as soft lead ores. Most of the soft lead ores produced in the United States are smelted into pig lead; but a substantial quantity is used each year in the manufacture of lead pigments, principally basic lead sulphate (white sublimed lead) and leaded zinc oxide. About one-fifth of the pig lead produced from soft lead ores is desilverized and used largely in the manufacture of white lead where high purity is required. Undesilverized soft lead containing relatively high copper is extremely resistant to corrosion by acids and is known to the trade as chemical lead; it is used chiefly in the manufacture of cable, pipe, and sheets.

The following table gives the production of soft lead during the past five years.

Soft lead produced in the United States from domestic ores, 1927–1931, in short tons

Year	Soft pig lead			Soft lead recovered in pigments	Total soft lead	Total domestic lead [1]	Soft lead percentage of domestic lead
	Undesilverized	Desilverized	Total				
1927	233,944	55,487	289,431	13,136	302,567	695,500	44
1928	225,003	49,465	274,468	10,465	284,933	652,492	44
1929	235,345	55,666	291,011	9,429	300,440	696,678	43
1930	201,361	45,578	246,939	6,686	253,625	588,042	43
1931	138,389	40,456	178,845	5,722	184,567	399,610	46

[1] Includes domestic refined lead, domestic lead in antimonial lead, and domestic lead in pigments. Domestic lead in antimonial lead computed on different basis in 1931. (See table on p. 357.)

ANTIMONIAL LEAD

Antimonial lead or hard lead is an important by-product of the refining of base bullion, but the amount derived from this source is only a small part of the country's yearly production. The principal uses of hard lead are in the manufacture of storage batteries, bearing metals, corrosion-resistant alloys, and type metal. A large percentage of the metal so used returns as scrap when the products have become worn out or obsolete. The smelting of such scrap provides the major part of the antimonial lead used, the remainder being supplied by the refining of base bullion and by mixing metallic antimony with refined soft lead.

Several lead-smelting plants operate on scrap materials exclusively. Production data from such plants are summarized in the Mineral Resources chapter on Secondary Metals. A large quantity of hard lead scrap is also treated at primary smelters and refineries, and the production of antimonial lead at these plants is shown in the table that follows. Prior to 1931 the chapters of this series on lead reported separately only primary antimonial lead, classifying it as domestic or foreign according to the origin of the ore from which it was derived. Owing to the increasing amounts of hard lead scrap being smelted at primary refineries and the fact that the antimony-lead ratios in the various materials charged to the furnace differ from the ratio in the final product, the above method of classification has become rather arbitrary. For this reason it has been deemed advisable to adopt a simpler method of presentation. Beginning with 1931 the total production of antimonial lead at primary refineries is reported, and its lead content is classified according to origin. As the smelter has a complete record of the lead content of the various materials charged to the furnace, fairly accurate separation of primary and secondary lead can be obtained.

Antimonial lead produced at primary lead refineries, 1927–1931

Year	Production (short tons)				Antimony content		Lead content by difference (short tons)			
	From domestic ore	From foreign ore	From scrap	Total	Short tons	Percentage	From domestic ore	From foreign ore	From scrap	Total
1927	16,040	8,307	9,592	33,939	3,775	11.1	(1)	(1)	(1)	30,164
1928	17,930	15,128	12,418	45,476	4,787	10.5	(1)	(1)	(1)	40,689
1929	17,062	8,607	17,575	43,244	4,935	11.4	(1)	(1)	(1)	38,309
1930	8,918	4,793	11,086	24,797	2,967	12.0	(1)	(1)	(1)	21,830
1931	(2)	(2)	(2)	21,842	2,438	11.2	3,628	1,603	14,173	19,404

[1] Not recorded.

[2] Segregation discontinued.

SECONDARY LEAD

Much of the lead consumed in the United States is used in the manufacture of articles from which there is a large return of secondary metal. This applies particularly to the storage-battery industry, a leading consumer of lead and the source of a large and rapid return of secondary metal. This industry is responsible for much of the increase in the ratio of secondary lead production to domestic primary lead production. In 1914 the secondary output was equivalent to only 12 per cent of the primary output from domestic ores; in 1931 the ratio was 60 per cent, an increase from 45 per cent in 1930. Other important lead-consuming industries in which there is a large return of secondary metal include cable manufacture, building, bearing-metal manufacture, and type-metal manufacture.

The following table shows the recovery of secondary lead and its ratio to the refined primary lead produced in the United States from domestic ores. Further details of the secondary lead industry may be found in the Mineral Resources chapter on Secondary Metals.

Secondary lead recovered in the United States, 1927–1931 [1]

Year	Pig lead (short tons)	Lead in alloys (short tons)	Total recovered lead		
			Short tons	Value	Ratio to domestic refined primary lead (per cent)
1927	119,000	157,000	276,000	$34,776,000	41
1928	138,000	170,600	308,600	35,797,600	49
1929	138,500	172,500	311,000	39,186,000	46
1930	129,000	126,800	255,800	25,580,000	45
1931	128,800	105,900	234,700	17,367,800	60

[1] Compiled by J. P. Dunlop, of the Bureau of Mines.

PIGMENTS

Lead pigments manufactured in 1931 contained 172,760 tons of lead from the sources shown in the following table. Refined pig lead is used in the manufacture of white lead, litharge, red lead, sublimed lead, and orange mineral. In 1931 about 166,000 tons of the lead contained in lead pigments were derived from refined pig lead; white lead accounted for 47 per cent; litharge, 36 per cent; red lead, 14 per cent; and sublimed lead and orange mineral, 3 per cent. Sublimed lead and leaded zinc oxide are the principal pigments in which the lead content is derived from ores.

Further details of the production and value of lead pigments in the United States are given in the Mineral Resources chapter on Lead and Zinc Pigments and Salts.

Lead in pigments,[1] 1927–1931, by sources, in short tons

Year	Lead in pigments from—			
	Domestic ore [2]	Metal	Scrap	Total
1927	13,136	242,713	1,246	257,095
1928	10,465	242,914	654	254,033
1929	9,429	248,657	2,427	260,513
1930	6,686	190,182	689	197,557
1931	5,722	166,328	710	172,760

[1] Includes also lead recovered in zinc oxide and leaded zinc oxide.
[2] No pigments from foreign ore.

MINE PRODUCTION

Mine production of lead decreased 28 per cent in 1931. Eighty-four per cent of the total was produced in three States; Missouri contributed 40 per cent, Idaho 24 per cent, and Utah 20 per cent. In 1930 these three States produced 80 per cent of the total. Compared with 1930 outputs in 1931 decreased as follows: Missouri 20 per cent, Idaho 26 per cent, and Utah 31 per cent; Oklahoma, which again ranked fourth, declined 43 per cent; and Colorado, which ranked fifth in 1930, fell to eighth in 1931 as the result of a 69 per cent decline in output. Production in Washington more than doubled as the result of increased activity in the Metaline Falls district.

Detailed information on the mining activities in the various districts of the United States can be found in the Mineral Resources chapters dealing with the mine production of gold, silver, copper, lead, and zinc in the various States.

The following tables show the mine production of recoverable lead by States and by districts from 1929 to 1931.

Mine production of recoverable lead, 1929–1931, by States, in short tons

State	1929	1930	1931	State	1929	1930	1931
Alaska	1,315	1,365	1,661	New York		(1)	(1)
Arizona	8,027	4,246	982	Oklahoma	46,513	23,052	13,210
Arkansas	51	53	78	Oregon	10	5	2
California	715	1,780	1,879	Tennessee		(1)	(1)
Colorado	24,445	22,130	6,884	Texas	425	198	
Idaho	148,695	134,058	99,365	Utah	149,377	115,495	79 212
Illinois	443	248	205	Virginia	(2)	(1)	(1)
Kansas	26,596	12,910	7,082	Washington	508	576	1,386
Kentucky	287	101		Wisconsin	1,536	1,537	952
Missouri	198,469	199,632	160,121	Undistributed		8,367	7,974
Montana	19,607	10,653	4,430				
Nevada	9,846	11,529	7,930		[3] 647,995	558,313	404,622
New Mexico	11,130	10,378	11,269				

[1] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.
[2] Bureau of Mines not at liberty to publish figures.
[3] Exclusive of the output from Virginia, figures for which the Bureau of Mines is not at liberty to publish.

Mine production of recoverable lead in the principal lead-producing districts of the United States, 1929–1931, in short tons

District	State	1929	1930	1931
Southeastern Missouri region	Missouri	197,435	198,622	158,950
Coeur d'Alene region	Idaho	141,558	129,311	97,771
Bingham	Utah	49,447	42,586	33,597
Joplin region	Kansas, Missouri, Oklahoma	74,143	36,972	21,463
Tintic	Utah	44,113	29,474	18,427
Park City region	do	42,570	30,875	17,368
Rush Valley	do	11,751	10,157	8,773
Willow Creek	New Mexico	5,720	5,431	7,563
Tybo	Nevada	1,991	3,622	4,083
Eagle County	Colorado	198	2,821	3,816
Eagle	Montana		1,287	3,489
Central	New Mexico	3,766	3,936	3,420
Pioche	Nevada	2,986	4,868	2,892
Inyo County	California	670	1,711	1,765
Leadville	Colorado	5,172	6,808	1,470
Metaline	Washington	328	267	1,257
Pend d'Oreille	Idaho	863	956	1,020
Upper Mississippi Valley	Iowa, Northern Illinois, Wisconsin.	1,536	1,537	952
San Juan Mountains	Colorado	17,386	11,722	908
San Francisco	Utah	691	1,883	436
Yellow Pine	Nevada	535	483	259
Bisbee (Warren)	Arizona	1,020	151	252
Jack Rabbit	Nevada	2,430	1,464	240
Kentucky-Southern Illinois	Kentucky-Illinois	730	349	205
Aspen	Colorado	710	396	136
Northport	Washington	76	254	128
Big and Little Cottonwood	Utah	173	125	117
Texas	Idaho	182	76	87
Eureka	Nevada	378	183	62
Port Hill	Idaho			43
Warm Springs	do	1,507	1,793	37
Montana	Montana	493	74	32
Spruce Mountain	Nevada	388	202	26

Mine production of recoverable lead in the principal lead-producing districts of the United States, 1929–1931, in short tons—Continued

District	State	1929	1930	1931
Cedar Plains	Montana	1,177	120	25
Vulture	Arizona	777	86	22
Barker	Montana	6,137	4,578	21
Summit County	Colorado	369	29	18
Ophir	Utah	25	18	13
Bryant	Montana	344	25	7
Troy	do	49		3
Butte	do	8,239	2,540	
Banner	Arizona	2,938	929	
Dome	Idaho	1,870	829	
Magdalena	New Mexico	481	479	
Boulder	Idaho	(1)	168	
Austinville [2]	Virginia	(1)	(1)	(1)
Embree [2]	Tennessee		(1)	(1)
Oro Blanco [2]	Arizona	(1)	(1)	
St. Lawrence County [2]	New York		(1)	(1)

[1] Bureau of Mines not at liberty to publish figures.

[2] Not listed according to rank.

LEAD SMELTERS AND REFINERIES

A list of primary lead smelters and refineries in the United States, Canada, and Mexico was given in the 1930 chapter of this series. During 1931 primary smelting operations were discontinued at the Balbach plant at Newark, N. J.

TARIFF

The tariff act of 1930 established duties as follows: 1½ cents per pound on lead content of ores, 2⅛ cents per pound on lead content of refined lead, base bullion, scrap, etc., and 2⅝ cents per pound on lead sheets, pipe, and wire. In February, 1931, the Tariff Commission was directed by a resolution of the United States Senate to investigate the differences in foreign and domestic costs of producing lead, but in December the resolution was rescinded and the investigation discontinued.

WORLD ASPECTS

WORLD SMELTER PRODUCTION

The following table shows the world smelter production of lead from 1927 to 1931, so far as statistics are available. Official figures are used wherever possible. The figures for countries where official data are not yet available are taken from the Year Book of the American Bureau of Metal Statistics and other reliable sources, but in later reports the official statistics will be substituted as received.

Duplication in figures showing world production is always possible, as some countries send "work lead" or base bullion to other countries for refining. Furthermore, secondary lead and antimonial lead are often included in the figures showing the foreign production, whereas the figures for the United States represent only refined primary lead that was smelted in this country, whatever the source of the ore; refined lead produced from foreign base bullion is excluded.

World production of lead, 1927–1931, in metric tons [1]

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [2]	1927	1928	1929	1930	1931
Argentina	7,800	8,291	9,020	8,882	7,609
Australia	167,616	157,565	180,358	171,248	152,850
Austria	8,086	8,135	6,569	6,935	6,117
Belgium	91,710	86,260	82,850	85,370	[3] 80,000
Canada	134,157	136,561	138,095	138,105	126,301
Chosen	824	719	333	130	[3] 200
Czechoslovakia	2,502	3,065	4,609	4,225	3,569
France	32,076	22,656	20,358	19,400	19,100
Germany [4]	84,000	87,000	97,900	110,800	101,300
Great Britain	6,132	8,638	10,839	10,383	10,723
Greece	5,325	7,306	5,361	7,329	6,971
India (Burma)	67,026	79,642	81,521	81,010	75,937
Indo-China	4	10	17	11	5
Italy	23,774	21,220	22,650	24,340	24,882
Japan	3,394	3,653	3,374	3,581	4,000
Mexico	230,782	227,860	233,154	219,370	220,956
Northern Rhodesia	5,951	4,751	1,661	----------	----------
Norway [3]	300	300	300	300	300
Peru	171	14,466	19,448	14,979	252
Poland	29,574	37,078	35,789	40,900	31,875
Portugal	60	84	94	89	108
Rumania	828	537	565	984	[3] 800
Russia	[5] 1,217	[5] 2,592	[5] 6,200	10,750	19,600
South-West Africa [6]	3,535	5,004	2,802	3,661	3,721
Spain	144,023	130,950	142,753	123,263	109,630
Sweden	330	----------	----------	----------	----------
Tunisia	18,662	17,606	18,850	19,400	19,112
Turkey	6,531	8,062	7,324	4,664	[3] 3,000
United States (refined) [7]	635,651	592,238	636,997	551,645	374,224
Yugoslavia	10,672	13,875	9,471	10,049	7,928
	1,723,000	1,686,000	1,779,000	1,672,000	1,411,000

[1] By countries where smelted but not necessarily refined.

[2] In addition to the countries listed China smelts lead, but no reliable data of output are available.

[3] Approximate production.

[4] Exclusive of secondary material. (Metallgesellschaft, Frankfort.)

[5] Year ended Sept. 30.

[6] Year ended Mar. 31 of year following that stated.

[7] Figures cover domestic refined and lead refined from foreign ore; refined lead produced from foreign base bullion not included.

The world smelter production of lead, as determined by the Bureau of Mines, was 1,411,000 metric tons in 1931, 16 per cent less than in 1930. The American Bureau of Metal Statistics estimates the 1931 output at 1,401,083 metric tons, 16 per cent less than its estimate for 1930; and the Metallgesellschaft, Frankfort on the Main, reports the 1931 world output as 1,387,100 tons, also 16 per cent below the 1930 output.

Smelter production of lead was reported from 28 countries in 1931; of these only 8 showed increases. Of the 13 countries that each produced at least 1 per cent of the world total 3 registered increases aggregating 10,978 tons and 10 decreases amounting to 250,812 tons. The tonnage decrease in the United States was nearly 10 times that in Australia, which had the second largest decrease. The United States also suffered the largest percentage decline (32 per cent) compared with 22 per cent in Poland, 11 per cent in Australia, and 9 per cent in both Canada and Germany.

The following table compares the average annual production from 1925 to 1929 with that in 1930 and 1931 for the principal lead-producing countries of the world. The table emphasizes the extent to which the United States has borne the brunt of curtailment during the present depression. In 7 of the 13 principal producing countries the 1931 output exceeded the yearly average from 1925 to 1929; and in only 2 countries, the United States and France, was the percentage decline greater than the world average. The lead production of the United States in 1931 was 41 per cent less than the yearly average from 1925 to 1929, whereas that of the rest of the world decreased less than 1 per cent. For the same two periods the share of the United States in world production dropped from 38 to 27 per cent, whereas that of the British Empire, Mexico, and Germany made large gains.

Recent trends in smelter production of lead in the principal producing countries of the world

Country	Per cent of world total			Index [1925–1929 average=100]	
	1925–1929 average	1930	1931	1930	1931
United States	37.7	33.0	26.5	87	59
Mexico	12.4	13.1	15.6	106	106
Australia	9.7	10.2	10.8	105	94
Canada	7.6	8.3	9.0	108	99
Spain	8.6	7.4	7.8	86	76
Germany	5.0	6.6	7.2	133	122
Belgium	5.2	5.1	5.7	98	92
India	3.9	4.8	5.4	122	115
Poland	1.9	2.4	2.3	129	100
Italy	1.4	1.5	1.8	105	108
Russia	.1	.6	1.4	435	792
Tunisia	1.1	1.2	1.3	109	107
France	1.4	1.2	1.3	84	83
All others	4.0	4.6	3.9	113	82
World total	100.0	100.0	100.0	100	84
British Empire	22.1	24.2	26.2	109	100

WORLD CONSUMPTION

World consumption of lead in 1931 was estimated by the American Bureau of Metal Statistics at 1,270,600 metric tons compared with 1,539,900 tons in 1930 and 1,693,000 tons in 1929. The 1931 consumption was 17 per cent below that in 1930 and 25 per cent below that in 1929. The consumption of zinc in 1931 was 27 per cent less and that of copper 33 per cent less than in 1929.

In the table that follows the lead consumption of the principal consuming areas of the world is shown for the 5-year period, 1925 to 1929, and for 1930 and 1931. In general, the figures represent production plus imports minus exports. Except for the United States and Great Britain, increases and decreases in stocks have not been taken into account for any countries separately listed. As there probably has been some increase in stocks in most of these countries, the trends shown are not precisely comparable. Nevertheless, the data indicate the severity of curtailment in the United States compared with other nations. World consumption in 1931 was 315,000 tons below the yearly average for 1925 to 1929; and consumption in the United States dropped nearly 286,000 tons, 91 per cent of the total decline. Comparing relative decreases in the same two periods it is found that consumption of lead in the United States decreased 44 per cent, whereas consumption elsewhere declined only 3 per cent. France and Russia maintained consumption at rates considerably above the average for 1925 to 1929. Consumption in Europe was maintained remarkably well, Germany being most seriously affected. Europe's share in world lead consumption increased from 49 per cent during 1925 to 1929 to 61 per cent in 1931, whereas that of the United States decreased from 41 to 28 per cent.

Recent trends in consumption of lead in the principal lead-consuming areas of the world [1]

Area	Metric tons			Index [1925–1929 average=100]		Per cent of world total		
	1925–1929 average	1930	1931	1930	1931	1925–1929 average	1930	1931
By countries:								
United States	647,380	521,800	361,600	81	56	40.9	33.9	28.4
Great Britain	262,180	270,000	260,000	103	99	16.5	17.6	20.5
Germany	199,960	165,300	136,800	83	68	12.6	10.7	10.8
France	92,540	146,400	132,300	158	143	5.8	9.5	10.4
Russia	35,560	61,000	62,000	172	174	2.2	4.0	4.9
Japan	58,180	59,000	57,600	101	99	3.7	3.8	4.5
Italy	44,640	42,300	40,400	95	91	2.8	2.7	3.2
Belgium	37,160	41,900	31,800	113	86	2.3	2.7	2.5
All others	208,440	232,200	188,100	111	90	13.2	15.1	14.8
World total	1,586,040	1,539,900	1,270,600	97	80	100.0	100.0	100.0
By continents:								
Europe	782,720	871,200	777,900	111	99	49.3	56.6	61.2
North and South America	706,920	578,200	406,100	82	57	44.6	37.5	32.0
Asia	77,260	75,200	73,600	97	95	4.9	4.9	5.8
Australia	16,000	12,000	10,000	75	63	1.0	.8	.8
Africa	3,140	3,300	3,000	105	96	.2	.2	.2

[1] Based on data shown on p. 55 of the 1931 Year Book of the American Bureau of Metal Statistics.

SUMMARY OF LEAD INDUSTRY IN IMPORTANT LEAD-PRODUCING COUNTRIES

AUSTRALIA

The smelter production of lead in Australia in 1931 was 150,436 long tons, a decrease of 11 per cent from 1930. The 1931 tonnage includes 133,306 tons of refined pig lead produced at Port Pirie, South Australia, and 17,130 tons of lead bullion exported, the latter being derived largely from the smelter at Mount Isa, Queensland, which operated in 1931 for the first time. Exports of refined lead and bullion declined from 152,216 tons in 1930 to 145,180 tons in 1931. Ninety-seven per cent of the 1931 total was shipped to Europe. Exports of lead in the form of ore totaled 15,872 tons in 1931 and 19,907 tons in 1930; Belgium was the principal customer.

The mine production of lead in 1931 was 150,764 tons, a decrease of 24 per cent from 1930. Eighty-six per cent of the total was derived from the lead and zinc concentrates produced in the Broken Hill district, about 12 per cent from Mount Isa, and 2 per cent from Tasmania. In the Broken Hill district the Zinc Corporation (Ltd.), Broken Hill South (Ltd.), and North Broken Hill (Ltd.) were the only companies operating in 1931; they treated 872,202 tons of ore, from which were obtained 125,736 tons of zinc concentrates and 172,079 tons of lead concentrates; the latter contained 126,722 tons of lead, 8,088 tons of zinc, and 5,386,457 ounces of silver. The ore treated in 1931 averaged approximately 15 per cent lead, 12 per cent zinc, and 7 ounces of silver.

Owing to extremely low zinc prices, only one company was saving the zinc content of the ore at the beginning of the year, and the continued decline in metal prices threatened to cause a complete shutdown of all activities in the district. This was averted, and zinc production was resumed by all active companies after adjustments in wages and freight rates. Another favorable factor was the 39 per cent decline in the exchange rate on Australian currency (United States gold basis) during 1931, which largely mitigated the effect of falling metal prices.

In Queensland, production of lead at Mount Isa began in June. Because the low price of zinc rendered its recovery unprofitable, the company decided to confine operations to ore containing as little zinc as possible. This led to utilization of a much larger percentage of zinc-free lead carbonate ore than was originally contemplated in the design of the plant, and in consequence metallurgical difficulties were encountered which prevented operation at full capacity. Instead of a monthly output of 6,000 tons of lead as planned, only 3,000 to 3,300 tons were obtained. The American Smelting & Refining Co., which owns a substantial interest in the controlling company and which acts as technical manager, was reported as having agreed to lend up to $1,000,000 for acquiring additional smelting equipment to raise production to rated capacity.

As a result of low metal prices the company reduced its estimate of ore reserves from 30,554,000 to 19,120,000 tons by the exclusion of 11,000,000 tons, assaying 4.8 per cent lead and 2.6 ounces of silver, mining of which was considered unprofitable at present metal prices. The recalculated reserves include 3,655,000 tons of carbonate ore assaying 9.4 per cent lead and 3.5 ounces of silver and 15,465,000 tons of sulphide ore assaying 8.4 per cent lead, 8.8 per cent zinc, and 5.1 ounces of silver.

In Tasmania lead production was derived largely from the North Mt. Farrell mine. The Rosebery mine was shut down in January, 1931, owing to low metal prices.

BELGIUM

Belgium ranked third in European lead production and seventh in world production in 1931 with an output estimated at 80,000 metric tons, 6 per cent under that for 1930. The lead smelted in Belgium is derived very largely from foreign lead ores; 56,000 tons were imported in 1931 compared with 40,160 tons in 1930. Much lead is also derived from the residues from foreign zinc ores smelted in Belgium. In 1931 Belgium imported 56,000 tons of pig lead, scrap, etc., and exported nearly 59,000 tons of lead in the form of pigs, pipes, sheets, etc.

CANADA

Canada ranked fourth in smelter production of lead in 1931, and contributed 9 per cent of the world total. Mine production declined 20 per cent, from 166,447 short tons in 1930 to 133,671 tons in 1931.

British Columbia contributed 98 per cent of the 1931 total, Yukon Territory less than 2 per cent, and Ontario less than one-half of 1 per cent. Exports of pig lead were 108,000 tons, of which Great Britain took 44 per cent, Japan 26 per cent, and Germany 7 per cent.

By far the largest part of the Canadian production is derived from the Sullivan mine of the Consolidated Mining & Smelting Co. in British Columbia. In 1931, 1,621,143 tons of ore were produced, or about 300,000 tons less than in 1930. Low costs obtained in 1930 were maintained in 1931 in spite of reduced tonnage and without increasing production in the higher-grade sections of the ore body. At the company metallurgical plants at Trail 1,647,773 tons of ore were treated, from which were obtained 24,968 ounces of gold, 6,572,119 ounces of silver, 608 tons of copper, 138,843 tons of lead, 101,124 tons of zinc, and 162 tons of cadmium. The addition of a slag fuming plant to treat the slag from the lead blast furnaces makes possible recovery of 23 per cent more zinc and 4 per cent more lead from the ore at lower cost than that of the cheapest metal made directly from Sullivan ore. This plant also made possible greater flexibility in the lead-smelting operation with lower unit costs.

The Kingdon Mining, Smelting & Manufacturing Co. closed its mine at Galetta, Ontario, permanently in May, 1931, and dismantled its smelter. Development at the Errington mine was discontinued until metal prices recover.

GERMANY

Germany ranks third in consumption of lead and sixth in smelter production. In 1931 it consumed about 137,000 metric tons and smelted about 101,000 tons, but mined only 48,500 tons. To meet the requirements of industry and the export trade, 65,000 tons of pig lead and 49,000 tons of lead ore were imported. There were exported 22,000 tons of ore and 30,000 tons of pig lead. Australia supplied 18 per cent of the lead ore imported, Sweden 14 per cent, Bolivia 9 per cent, and Italy 7 per cent. The principal sources of the pig lead were Australia, with 38 per cent of the total, and Mexico, with 27 per cent. Most of the lead ore exported from Germany was produced in Upper Silesia and shipped to near-by smelters in Poland. The pig-lead export went to neighboring European countries.

During the current depression primary production of lead has been fairly well maintained, in spite of a severe decline in consumption. Comparing 1931 with the 5-year (1925 to 1929) average, it is found that consumption dropped 32 per cent, whereas smelter production increased 22 per cent and mine production 4 per cent. Mine production was maintained by Government subsidies to some of the principal producers during 1930 and 1931. During the first half of 1932 the policy of Government aid through loans was continued on a broader basis by the creation of a 6,000,000-mark fund, to be advanced to privately operated lead and zinc mines.

GREAT BRITAIN

Great Britain produces less than 1 per cent of the world's lead but ranks second in consumption; in 1931 it consumed 20.5 per cent of the total. Nearly 300,000 long tons of lead were imported in 1931, of which 66 per cent came from the British Dominions of

Australia, Canada, and India and 27 per cent from Mexico and the United States. Approximately 18,500 tons of pig lead were reexported, and lead stocks increased greatly during 1931.

The new lead refinery of the Britannia Lead Co., which was designed to refine base bullion from Mount Isa, began operating in October. The plant has a rated capacity of 6,000 tons per month, but owing to the failure of the Mount Isa smelter to make the production expected, the full capacity of the refinery was not realized.

Abandonment of the gold standard in September, 1931, had no appreciable effect upon the British lead trade. Imposition of a 10 per cent tariff on March 1, 1932, succeeded in greatly curtailing imports of non-British lead during April and May, but subsequently the importation of foreign lead was resumed.

Lead consumption in Great Britain has held up remarkably well during the current depression. During the 5-year period 1925 to 1929 the yearly consumption averaged about 258,000 long tons; during 1930 it was about 266,000 tons; and in 1931, 256,000 tons, the latter being equivalent to 99 per cent of the average for 1925 to 1929. In the British Empire as a whole production has also been well maintained. From 1925 to 1929 the yearly output averaged 364,000 tons. In 1930 the output was 398,000 tons, but in 1931 it declined to 364,000 tons. The lead consumption of the Empire in 1931 was estimated at approximately 300,000 tons, indicating a surplus production of 64,000 tons (about 21 per cent of the total consumption).

INDIA

The Burma Corporation, the only lead producer of any importance in India, curtailed production as of May 1, 1931, in accordance with lead-cartel agreements. During the fiscal year ended June 30, 1931, the company mined 462,184 long tons of ore averaging 21.9 per cent lead, 11.4 per cent zinc, 1.62 per cent copper, and 19.5 ounces of silver. The tonnage was 7.7 per cent below that of the preceding year. Production of refined lead declined 3.5 per cent to 76,520 tons. Other products included 6,512,780 ounces of silver, 52,685 tons of zinc concentrates, 17,274 tons of copper matte, 3,449 tons of nickel speiss, and 1,555 tons of antimonial lead. Ore reserves as of June 30, 1931, were estimated at 4,233,120 tons assaying 25.5 per cent lead, 20.1 ounces of silver, 15.3 per cent zinc, and 0.76 per cent copper.

MEXICO

Smelter production of lead in Mexico increased nearly 1 per cent in 1931, but mine production decreased nearly 3 per cent. Among the factors that made possible maintenance of production at such high levels were decline in the foreign exchange value of Mexican currency and revision of the labor laws. It was also reported that Russia had purchased large quantities of Mexican lead during 1931.

About 230,000 tons of lead were exported in 1931—84 per cent in the form of refined lead, 12 per cent in base bullion, 1 per cent in antimonial lead, and 3 per cent in ores and concentrates. Much of the ore and base bullion is shipped to the United States, and most of the refined lead goes to Europe.

SPAIN

Notwithstanding the low prices for lead and the political disturbances in Spain the decline in lead production was less severe than was expected. Smelter production declined from 123,263 metric tons in 1930 to 109,630 tons in 1931 (11 per cent); and mine production, according to Metallgesellschaft, fell from 109,500 to 100,700 tons (8 per cent). Exports of pig lead declined from 89,000 to 83,000 tons. France took 41 per cent of the 1931 total, Great Britain 20 per cent, Russia 16 per cent, and other countries 23 per cent. The 19 per cent decline in the foreign exchange value of the peseta during 1931 (United States gold basis) favored Spanish producers, as most of the lead was exported.

IMPORTS

The United States normally imports much lead in various forms, principally in base bullion and ore. Some of it is entered for immediate consumption; most of it, however, is entered for warehouse, is smelted and refined in bond, and is then reexported as refined pig lead or in manufactured products.

The following table shows the general imports of lead into the United States, by classes, including both imports for immediate consumption and imports for warehouse. Of the total lead imported in 1931, 61 per cent was in base bullion, 39 per cent in ore, and less than 0.1 per cent in reclaimed scrap, etc., imported under the classification "pigs, bars, sheets, and old." Imports of all three classes showed declines, shipments of base bullion falling off 16 per cent, ore 47 per cent, and pigs, bars, etc., 95 per cent. Total imports of lead in 1931 were 32 per cent below 1930, 67 per cent below the record year 1927, and the lowest since 1916.

Lead imported into the United States, 1927–1931, by classes, in pounds

[General imports]

Year	Lead in ore	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1927	81,276,126	236,567,252	4,934,749	322,778,127
1928	51,829,530	256,935,461	1,323,158	310,088,149
1929	62,661,371	166,141,916	3,315,481	232,118,768
1930	78,753,878	77,260,580	418,906	156,433,364
1931	41,775,674	64,639,608	[1] 19,863	106,435,145

[1] Reclaimed scrap, etc. No imports of pigs, bars, etc., recorded for 1931.

The next table shows general imports of lead by countries. Mexico supplied 73 per cent of the 1931 total, Newfoundland 18 per cent, Canada 5 per cent, and South America (reported as Chile but principally Bolivia) 4 per cent. Imports from Canada and South America decreased 85 and 90 per cent, respectively, whereas shipments from Mexico and from "Other countries" increased; the large increase in the "Other countries" total was due to large shipments of lead concentrates from the Buchans mine in Newfoundland.

Lead imported into the United States, in ore, base bullion, and refined, 1927–1931, by sources, in pounds

[General imports]

Year	Canada	Mexico	South America	Europe	Other countries	Total
1927	6,214,867	300,634,815	14,583,513	1,226,049	118,883	322,778,127
1928	14,352,967	275,184,287	20,408,574	56,406	85,915	310,088,149
1929	9,023,527	175,872,302	47,052,018	29,441	141,480	232,118,768
1930	34,536,897	73,442,591	44,943,694	226,294	3,283,888	156,433,364
1931	5,236,264	77,410,574	4,342,077	----------	[1] 19,446,230	106,435,145

[1] Of this total 19,415,545 pounds were from Newfoundland and Labrador.

The following tables show the imports of lead in ore, matte, and base bullion, by countries.

Lead imported into the United States, in ore and matte, 1927–1931, by countries, in short tons

[General imports]

Country	1927	1928	1929	1930	1931
Canada	2,558	7,131	3,953	17,257	2,614
Chile	3,877	504	2,295	3,313	1,866
Mexico	30,615	17,055	23,415	16,341	6,495
Newfoundland and Labrador	----------	----------	(1)	----------	9,708
Peru	3,415	1,170	1,601	831	194
Other countries	173	55	67	1,635	11
	40,638	25,915	31,331	39,377	20,888

[1] 671 pounds.

Lead imported into the United States, in base bullion, 1927–1931, by countries, in short tons

[General imports]

Country	1927	1928	1929	1930	1931
Mexico	117,938	119,935	63,458	20,350	32,210
Peru	----------	8,525	19,605	18,280	110
Spain	336	----------	----------	----------	----------
Other countries	10	8	8	----------	----------
	118,284	128,468	83,071	38,630	32,320

Statistics on imports for consumption, as shown in the tables that follow, include imports entered for immediate consumption and withdrawals from warehouse for domestic consumption. As most of the lead imported is smelted and refined in bond and reexported, the total imported for consumption is considerably less than general imports. In 1931, imports for consumption were equivalent to only about 41 per cent of the general imports of lead.

Lead remaining in warehouse in the United States, December 31, 1927–1931, in pounds

[Stated in the form in which the material was entered for warehouse]

Year	Ore (lead content)	Base bullion (lead content)	Pigs, bars, and old	Year	Ore (lead content)	Base bullion (lead content)	Pigs, bars, and old
1927	99, 526, 339	126, 669, 674	[1] 19, 326, 011	1930	79, 031, 855	[2] 11, 283, 785	([2])
1928	97, 645, 207	137, 500, 524	8, 278, 733	1931	105, 697, 107	[2] 10, 686, 206	([2])
1929	120, 413, 999	150, 868, 776	2, 656, 648				

[1] Includes 397,712 pounds of lead in reclaimed scrap. Corresponding figures for 1928 and 1929 not recorded separately.

[2] Pigs, bars, and old included with base bullion; not recorded separately for 1930 and 1931.

Lead imported for consumption in the United States, 1927–1931, by classes

Year	Lead in ore and matte[1]		Lead in base bullion		Pigs, bars, and old		Sheets, pipe, and shot		Not otherwise specified	Total value
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value		
1927	70, 260, 478	$4, 203, 897	14, 629, 606	$925, 328	9, 933, 679	$635, 807	988, 170	$104, 890	$52, 626	$5, 922, 548
1928	46, 511, 508	2, 626, 231	13, 397, 455	560, 983	20, 488, 373	808, 359	775, 329	67, 131	134, 995	4, 197, 699
1929	21, 645, 699	1, 160, 533	12, 395, 696	627, 455	20, 178, 922	1, 052, 087	899, 595	78, 776	126, 966	3, 045, 817
1930	30, 915, 964	1, 461, 350	20, 846, 713	1, 127, 920	1, 141, 442	60, 493	908, 809	78, 737	87, 612	2, 816, 112
1931	21, 467, 418	1, 194, 191	20, 871, 628	671, 002	[2] 19, 863	[2] 1, 763	855, 341	60, 536	49, 990	1, 977, 482

[1] Classification as follows: Jan. 1, 1927, to June 17, 1930, "Lead in ore and matte"; June 18, 1930, through 1931, "Lead in ores, flue dust, and mattes, n.s.p.f."

[2] Reclaimed scrap, etc. No imports of pigs, bars, etc., recorded for 1931.

Miscellaneous products containing lead imported for consumption in the United States, 1927–1931

Year	Babbitt metal, solder, white metal, and other combinations, containing lead			Type metal and antimonial lead		
	Gross weight (pounds)	Lead content (pounds)	Value	Gross weight (pounds)	Lead content (pounds)	Value
1927	2, 527, 186	1, 237, 277	$932, 055	878, 346	666, 654	$65, 049
1928	1, 876, 432	845, 199	569, 486	3, 990, 548	3, 086, 770	193, 177
1929	3, 010, 465	1, 326, 102	777, 354	5, 440, 857	4, 849, 979	180, 679
1930	2, 797, 463	1, 060, 556	593, 103	656, 841	550, 444	32, 934
1931	1, 812, 653	619, 861	436, 574	------------	------------	------------

EXPORTS

The chief lead export of the United States is refined pig lead derived from treatment of foreign ores and base bullion. Exports decreased 55 per cent in 1931, amounted to only 17 per cent of the record export in 1927, and were the lowest since 1920. Asia took 85 per cent of the 1931 total, South America 9 per cent, Europe 4 per cent, and North America 2 per cent. Shipments to Asia increased 7 per cent due mainly to larger exports to Japan, whereas shipments to Europe decreased 97 per cent. Japan was the largest importer in 1931 with 80 per cent of the total, and Brazil ranked second with 6 per cent. United Kingdom, Sweden, Denmark, and

France each took several thousand tons in 1930, but in 1931 the combined exports to these countries amounted to only a little over 700 tons.

Refined pig lead exported from the United States, 1930 and 1931, by destinations

Destination	1930		1931	
	Short tons	Value	Short tons	Value
North America:				
Canada	9	$1,262	58	$20,714
Cuba	107	10,952	40	3,109
Mexico	40	6,454	171	13,409
Panama	91	10,540	129	11,572
Other	71	8,500	37	3,540
	318	37,708	435	52,344
South America:				
Argentina	934	75,400	226	12,646
Brazil	874	65,542	1,382	70,271
Chile	224	21,673	95	7,036
Colombia	25	3,071	6	696
Ecuador	(1)	91	----------	----------
Peru	11	1,286	18	775
Uruguay	364	30,242	145	7,461
Other	10	1,271	31	2,531
	2,442	198,576	1,903	101,416
Europe:				
Belgium	576	61,915	17	847
Denmark	5,205	398,165	----------	----------
France	3,001	239,444	318	17,711
Germany	823	68,755	52	2,385
Italy	532	41,070	----------	----------
Netherlands	22	2,200	13	1,400
Sweden	7,557	601,335	392	21,727
United Kingdom	9,157	710,080	3	692
Other	1,026	79,662	----------	----------
	27,899	2,202,626	795	44,762
Asia:				
China	953	78,843	(1)	20
Japan	15,653	1,293,142	17,301	973,368
Philippine Islands	543	49,208	400	28,210
Other	140	11,310	823	41,256
	17,289	1,432,503	18,524	1,042,854
Africa	358	32,557	8	505
Oceania: Australia	1	243	----------	----------
	48,307	3,904,213	21,665	1,241,881

[1] Less than 1 ton.

Refined lead exported from the United States, 1927–1931

Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of drawback (short tons)	Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of drawback (short tons)
	Short tons	Value			Short tons	Value	
1927	125,267	$12,817,264	12,004	1930	48,307	$3,904,213	12,161
1928	116,269	10,359,221	13,224	1931	21,665	1,241,881	10,503
1929	73,251	7,178,337	13,086				

CONSUMPTION

REFINED PRIMARY PIG LEAD AVAILABLE FOR DOMESTIC CONSUMPTION

The manufacturing industry of the United States consumes lead in four main forms—refined primary pig lead, primary lead in the form of ore, antimonial lead containing both primary and secondary lead, and secondary pig lead and alloys.

The following table shows the refined primary lead available for consumption from 1927 to 1931. It is intended to include only primary lead or lead smelted directly from ore. There are, however, some small discrepancies which should be pointed out. Many primary lead smelters produce from secondary materials some lead that is inseparable from the primary lead in the final product. Exports of lead as reported in this table may therefore contain some secondary lead. There are also some inaccuracies in the statistics of imports, exports, and warehouse transactions. Nevertheless, on the basis of the data available, the table gives approximately the quantity of new refined lead available to American industry each year. As the table does not consider fluctuations in producers' and consumers' stocks it indicates the trend of consumption only in a general way.

Refined primary pig lead available for consumption in the United States, 1927–1931, in short tons

	1927	1928	1929	1930	1931
Supply:					
Stock in bonded warehouse Jan. 1	10,711	9,464	4,139	1,328	(1)
Imports of pigs, bars, and old	2,467	662	1,658	209	10
Production	796,530	781,071	774,633	643,033	442,764
	809,708	791,197	780,430	644,570	442,774
Withdrawn:					
Exports—					
Pig lead	125,267	116,269	73,251	48,307	21,665
In manufactures, with benefit of drawback	12,004	13,224	13,086	12,161	10,503
Stock in bonded warehouse Dec. 31	9,464	4,139	1,328	(1 2)	(1)
	146,735	133,632	87,665	61,796	32,168
Supply available for consumption	662,973	657,565	692,765	582,774	410,606

[1] Stocks of pigs, bars, etc., in bonded warehouse not separately recorded after April, 1930, but included with base bullion. (See table on p 369.)

[2] For purpose of calculating quantity available for domestic consumption, stocks in warehouse are estimated to have remained unchanged from the beginning of the year.

CONSUMPTION BY USES

The quantity of lead in all forms consumed by American industry is estimated each year by the American Bureau of Metal Statistics. The following table is quoted from the 1931 yearbook of that bureau.

Lead consumed in the United States,[1] 1927–1931, in short tons

Purpose	1927	1928	1929	1930	1931
White lead [2]	126, 000	123, 000	119, 700	83, 900	77, 500
Red lead and litharge [3]	38, 000	31, 000	30, 000	32, 000	18, 000
Storage batteries [4]	175, 000	220, 000	210, 000	163, 000	157, 000
Cable covering [4]	161, 000	180, 000	220, 000	208, 000	117, 000
Building [5]	88, 000	96, 000	96, 000	67, 000	40, 000
Automobiles [5]	12, 000	17, 000	18, 000	11, 000	6, 000
Railway equipment [5]	3, 350	2, 500	5, 700	5, 200	1, 000
Shipbuilding [5]	200	100	300	500	400
Ammunition [4]	34, 000	39, 600	41, 100	33, 300	29, 700
Terneplate [4]	3, 900	4, 400	4, 200	2, 700	2, 200
Foil [4]	30, 000	35, 000	39, 800	26, 000	20, 000
Bearing metal [6]	31, 000	32, 000	33, 000	20, 000	12, 000
Solder [7]	35, 000	37, 000	37, 000	27, 000	20, 500
Type metal [7]	16, 000	17, 000	18, 000	16, 000	14, 400
Calking [7]	30, 000	32, 000	31, 500	21, 000	15, 000
Castings [7]	17, 000	18, 000	18, 000	12, 000	7, 000
Other uses [8]	40, 500	46, 000	50, 000	40, 000	30, 000
Total	840, 950	930, 600	972, 300	768, 600	567, 700

[1] Source: American Bureau of Metal Statistics. These estimates are for the total consumption of lead, irrespective of whether its origin be primary or secondary. Antimonial lead is included and the manufacture of lead for export under drawback provisions is included.

[2] From data of sales reported by U. S. Bureau of Mines for 1927. Later figures have been determined by an improved method.

[3] Exclusive of oxides for storage batteries

[4] Based on reports from a large proportion of manufacturers in each industry.

[5] Based on estimates of manufacture and the quantity of lead used per unit of manufacture. Under the head of building is included the lead used in chemical construction.

[6] Based on the estimated consumption of lead for this purpose by the railways.

[7] Estimates of persons engaged in the trades.

[8] Conjectural.

According to the foregoing table the lead consumed in the United States in 1931 was only 567,700 tons, a decrease of 26 per cent from 1930 and 42 per cent from 1929, the year of record consumption. The 1931 consumption was 9 per cent greater than that in 1921. As these two years represent periods of marked curtailment in industrial activity, it is interesting to compare them from the standpoint of the relative importance of the principal lead-consuming industries. In 1921 white lead ranked first in lead consumption and accounted for 26 per cent of the total; storage batteries ranked second with 17 per cent, cable covering third with 13 per cent, and building fourth with 9 per cent. By 1931 white lead had fallen to third place, accounting for only 14 per cent of the total; storage batteries ranked first with 28 per cent, cable covering second with 21 per cent, and building fourth with 7 per cent. If tonnages of lead used in these four industries in 1921 and 1931 are compared, it is found that white lead and building declined 43 and 17 per cent, respectively, whereas storage batteries and cable covering increased 80 and 75 per cent, respectively.

Consumption of lead in storage batteries was fairly well maintained in 1931 compared with 1930, the decline amounting to only 4 per cent, due to the importance of battery replacements in automobiles. The American Bureau of Metal Statistics estimates the production of automobile storage batteries at 12,000,000 in 1931 and 13,000,000 in 1930. Virtually all this decline is accounted for by the decline in manufacture of automotive units, which decreased from 3,355,986 in 1930 to 2,389,730 in 1931 (29 per cent). Production of radio storage batteries declined from approximately 400,000 in 1928 to 60,000 in 1930 but rose to 80,000 in 1931. Exports of storage batteries of all kinds decreased from 399,000 in 1930 to about 314,000 in 1931; in 1925 only 207,000 storage batteries were exported. The 157,000 tons of lead used in the manufacture of storage batteries in 1931 included approximately 7,500 tons of soft pig lead, 83,000 tons of antimonial pig lead, and 66,500 tons of lead in the form of oxides.

A possible competitor of the lead storage battery is the zinc-iodine battery recently invented in France. The inventor claims that the battery is superior to the present lead or nickel-iron batteries. It is said the plates do not disintegrate, there is no acid or caustic liquid to spill, no dangerous gases or vapors are given off, and continual maintenance is not necessary. The iodine battery is very rugged and easily transported. A disadvantage is high internal resistance, but high output is obtained by placing a number of cells in parallel.[3] The development of this new battery apparently has not yet reached the commercial stage.

The second largest use of lead in the United States in 1931 was cable covering, which ranked first in 1929 and 1930. The 44 per cent decline in this outlet for lead in 1931 reflects the falling off in power and communication businesses during the present slump. Installation of new cable and replacements generally require large capital investments and are usually made with the expectation of a normal increase in demand. As demand showed a reverse trend in the past two years, many companies probably felt obliged to forego large capital commitments until prospects for improved business were brighter. Possibilities for consumption of large quantities of lead in cable covering during the next decade are suggested by the fact that one company operating in the New York metropolitan area estimates its requirements for new lead during the next 10 years at 60,000 tons.

Compared with most of the principal lead-consuming industries, manufacture of white lead was well maintained in 1931. This pigment has suffered a steady decline in production since 1924, due to competition from cheaper white pigments, but the experience of 1931 seems to indicate that at the low prices prevailing in that year white lead more than held its own in the paint trade. Sales of white lead to the paint industry increased slightly in 1931, whereas consumption of lithopone in paint decreased over 5 per cent, and total sales of zinc oxide decreased 20 per cent.

Consumption of lead in nonindustrial uses (ammunition and type metal) was maintained at a much higher rate than that in industrial uses such as building, solder, foil, bearing metals, and automobile construction. No outstanding new uses were developed in 1931.

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[3] Science News Letter, vol. 21, No. 584, June 18, 1932, p. 388.

PRICES

The two major markets for lead in the United States are New York and St. Louis, and a large part of the lead produced in the United States is sold at prices based on quotations in these markets. The New York quotations are influenced to some extent by the lower prices usually prevailing on the London market, so that the New York price seldom exceeds the St. Louis price by as much as the freight differential, 0.35 cent a pound.

The following table shows the average monthly and yearly quoted prices of lead at St. Louis, New York, and London for 1929 to 1931.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1929–1931, in cents per pound[1]

Month	1929			1930			1931		
	St. Louis	New York	London	St. Louis	New York	London	St. Louis	New York	London
January	6.50	6.65	4.79	6.10	6.25	4.68	4.60	4.80	3.01
February	6.73	6.86	5.01	6.09	6.24	4.60	4.33	4.54	2.92
March	7.38	7.50	5.50	5.56	5.67	4.08	4.28	4.53	2.85
April	7.03	7.20	5.37	5.43	5.53	4.09	4.17	4.39	2.69
May	6.77	7.00	5.19	5.41	5.51	3.86	3.65	3.82	2.50
June	6.80	7.00	5.13	5.31	5.39	3.89	3.76	3.92	2.52
July	6.61	6.80	4.94	5.15	5.23	3.94	4.22	4.40	2.76
August	6.55	6.75	5.02	5.33	5.49	3.98	4.22	4.40	2.59
September	6.69	6.89	5.10	5.35	5.49	3.89	4.22	4.33	2.41
October	6.67	6.87	5.05	5.00	5.15	3.42	3.78	3.96	2.30
November	6.13	6.29	4.71	4.95	5.10	3.45	3.76	3.94	2.42
December	6.10	6.25	4.68	4.95	5.10	3.31	3.59	3.79	2.29
Average	6.66	6.83	[2] 5.04	5.38	5.52	[2] 3.92	4.05	4.24	[2] 2.64

[1] St. Louis: Metal Statistics, 1932, p. 349. Average daily quotations of soft Missouri lead, f. o. b. St. Louis (open market), as reported daily in the American Metal Market.

New York: American Metal Market, daily issues. Pig lead, New York (outside market), prompt shipment from West.

London: Metal Statistics, 1932, p. 353. Average price of foreign lead. Price per long ton, as published in Metal Statistics, converted to cents per pound at average exchange rate reported by the Federal Reserve Board.

[2] London quotations in pounds sterling per long ton as follows: 1929, £23.246; 1930, £18.075; 1931, £13.029.

To facilitate the settlement of its buying and selling contracts for lead the American Smelting & Refining Co., which controls a large part of the United States lead production, at frequent intervals publishes an official contract price based on the New York market. Following are the company's quotations for 50-ton lots, f. o. b. New York, in 1930 and 1931, in cents per pound.

1930				1931					
Feb. 27	6.10	May 20	5.50	Jan. 5	5.00	May 8	3.85	Nov. 9	3.95
Mar. 3	6.00	June 17	5.40	Jan. 7	4.85	May 11	3.75	Nov. 10	4.05
Mar. 6	5.85	June 23	5.25	Jan. 8	4.75	June 22	4.00	Nov. 19	3.95
Mar. 7	5.75	Aug. 1	5.35	Feb. 3	4.60	June 23	4.15	Nov. 23	3.85
Mar. 8	5.60	Aug. 4	5.50	Feb. 4	4.50	June 24	4.25	Dec. 14	3.75
Mar. 10	5.50	Oct. 1	5.35	Feb. 19	4.60	June 25	4.40		
Mar. 25	5.65	Oct. 4	5.25	Mar. 10	4.50	Oct. 2	4.25		
Mar. 26	5.75	Oct. 8	5.20	Apr. 23	4.35	Oct. 5	4.00		
Apr. 4	5.60	Oct. 9	5.15	Apr. 24	4.25	Oct. 20	3.75		
Apr. 7	5.50	Oct. 10	5.10	Apr. 28	4.10	Oct. 28	4.00		
May 13	5.60			Apr. 29	4.00	Nov. 2	3.85		

The average price of lead (New York) during 1931 was 4.24 cents per pound, a decrease of 23 per cent from 1930 and the lowest yearly average since 1914; it was less than half the record average of 9.02 cents in 1925. The quotation at the beginning of the year was 5.10 cents, but by the end of May it had declined to 3.75 cents. Announcement of the debt moratorium during the latter part of June caused an upward movement which continued until the quotation reached 4.40 cents, where it remained throughout July, August, and September. Early in October, as a result of the declining London market, a downward trend was resumed, and at the close of the year the price stood again at 3.75 cents.

The London quotation (gold basis) averaged 2.64 cents in 1931. The London average for December was 0.72 cent below the January average, whereas in New York the decline amounted to 1.01 cents. As in 1930, the yearly average of London quotations in 1931 was 1.60 cents below New York.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN ARIZONA[1]

(MINE REPORT)

By C. N. Gerry and T. H. Miller[2]

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SUMMARY

In 1931 the mines of Arizona produced gold, silver, copper, and lead valued at $40,144,694, a decrease of more than 50 per cent ($40,897,722) from the value of metals produced in 1930 and of 74 per cent from that in 1929. The value of the metal output, however, was larger than in any other State; the value of the copper represented 91 per cent of the total. The decrease in total value was chiefly the result of the abnormal decrease in quantity and average price of copper; the output of the other metals and the average price of silver, lead, and zinc also decreased. As the average price of copper fell from 13 cents a pound in 1930 to 9.1 cents in 1931 (as low as 6.025 cents in December), all the large producers of copper curtailed their output considerably and several of the important producers were closed before June, when the price dropped to about 8 cents. The total dividends paid and published by companies operating mining property in Arizona in 1931, with an estimate of dividends paid but not published, amounted to $6,697,500. In addition, the Phelps Dodge Corporation, operating mines at Bisbee and Morenci, Ariz., and in New Mexico and Mexico, paid $2,117,042; and the Nevada Consolidated Copper Co., operating mines at Ray, Ariz., McGill, Nev., and Santa Rita, N. Mex., paid $3,885,798.

The average value in metals recovered per ton of ore, old tailings, etc., decreased from $4.01 in 1930 to $2.87 in 1931; the average value per ton in gold and silver decreased from 28 to 26 cents.

The chief producing counties in 1931, in order of total value of metals recovered, were Gila, Cochise, Pinal, Yavapai, Pima, and Greenlee, all large copper producers.

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[1] Work on manuscript completed August, 1932.

[2] The assistance of Paul Luff and Jeannette Froiseth, of the Bureau of Mines, is appreciated.

During the decade 1922 to 1931, 65 per cent of the gold was recovered from copper ore and 31 per cent from dry and siliceous ore; most of the silver came from copper ore, with smaller amounts from siliceous ore and lead ore; copper, for which the State is famous, came almost entirely from copper ore; and nearly 85 per cent of the lead, the output of which has been decreasing decidedly since 1926, came from lead ore. The zinc produced in the past 10 years has come largely from zinc ore and lead-zinc ore; there was no output of zinc in 1931.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064	1930	$0.385	$0.130	$0.050	$0.048
1928	.585	.144	.058	.061	1931	.290	.091	.037	.038
1929	.533	.176	.063	.066					

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1927–1931, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver		Copper		Lead		Zinc		Total value
	Lode	Placer		Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
1927	293	15	21,991,874	200,494.59	$4,144,591	6,847,680	$3,882,635	682,190,547	$89,366,962	19,865,961	$1,251,556	2,268,960	$145,213	$98,790,957
1928	298	22	22,828,766	191,927.23	3,967,488	6,791,351	3,972,940	732,276,803	105,447,860	14,380,964	834,096	1,278,636	77,997	114,300,381
1929	390	22	25,860,772	202,318.14	4,182,287	7,543,283	4,020,570	830,628,411	146,190,600	16,054,122	1,011,410	2,458,580	162,266	155,567,133
1930	301	41	19,802,919	169,390.38	3,501,610	5,540,732	2,133,182	576,190,607	74,904,779	8,491,623	424,581	1,630,506	78,264	81,042,416
1931	252	68	13,690,610	126,185.94	2,608,495	3,245,311	941,140	401,344,909	36,522,387	1,964,112	72,672	----------	----------	40,144,694

GOLD

In 1931 the production of gold in Arizona was $2,608,495, the smallest output in any year since 1908 and a decrease of more than 25 per cent from 1930. The largest decreases occurred in Yavapai and Cochise Counties and were due chiefly to the marked curtailment in the output of copper ore at the United Verde, United Verde Extension, Calumet and Arizona, and Shattuck-Denn mines. As in

1930, the large increase in the output of siliceous gold ore from the Tom Reed mine at Oatman, Mohave County, prevented a much larger decrease in the production of gold in Arizona in 1931. Decreases in gold production were also reported from the Old Dominion mine at Globe and the Montana mine of the Eagle-Picher Lead Co. at Ruby. Of the total output of gold, more than 28 per cent was recovered from ore and old tailings treated in gold and silver mills, nearly 24 per cent from ore concentrated, and more than 46 per cent from crude ore shipped for smelting; 64 per cent came from copper ore, old tailings, etc. Ores treated by amalgamation yielded gold valued at $40,029 in 1931 and ore and old tailings treated by cyanidation, $700,848. Concentrates yielded gold valued at $619,157 in 1931 and crude ore smelted, $1,211,541. The chief gold-producing districts in 1931 were the Warren in Cochise County, the San Francisco in Mohave County, the Verde in Yavapai County, the Ajo in Pima County, the Pioneer in Pinal County, the Greenlee in Greenlee County, and the Globe in Gila County.

The Tom Reed Gold Mines Co. at Oatman was the largest producer of gold in Arizona in 1931; it was followed by the Copper Queen branch of the Phelps Dodge Corporation at Bisbee, the Calumet and Arizona property near Bisbee, the New Cornelia mine at Ajo, the United Verde mine at Jerome, the Magma property at Superior, the United Verde Extension mine at Jerome, and the Morenci branch of the Phelps Dodge Corporation at Morenci. Increases in gold output were reported at the Tom Reed, Copper Queen, and New Cornelia properties. The United Verde mine at Jerome, the largest producer of gold in Arizona from 1924 to 1930, inclusive, suspended production of ore in May, 1931, and dropped from first to fifth place as a gold producer.

SILVER

The production of silver in Arizona in 1931 decreased more than 41 per cent; the value decreased nearly 56 per cent, as the average price of silver declined from 38.5 cents an ounce in 1930 to 29 cents in 1931. The decrease in the output of silver, as well as that in gold, was due to the curtailed output of copper ore, as most of the silver and gold from Arizona is recovered from copper bullion. The average annual silver production of the State during the decade 1922 to 1931 was 6,313,213 ounces. The output declined from the peak of 7,543,283 ounces in 1929 to 5,540,732 ounces in 1930, and to 3,245,311 ounces in 1931, nearly 49 per cent below the average for the decade. The State, however, maintained its position as the fourth largest producer of silver in the United States, after Utah, Idaho, and Montana. There were decreases in silver output in all counties except Pima; those in Yavapai, Cochise, Pinal, Gila, and Santa Cruz Counties were unusually large. The greatest decrease, that of the United Verde Copper Co., accounted for nearly one-half of the total for the State; other companies that reported decided decreases in silver were the Calumet and Arizona, Shattuck-Denn, Magma, United Verde Extension, and Eagle-Picher Lead (Montana mine). A fair increase, however, was made at the Copper Queen property of the Phelps Dodge Corporation. Bullion from ores and old tailings treated at gold and silver mills contained 23,634 ounces of silver recovered by cyanidation and 1,217 ounces recovered by amalgamation. Concentrates yielded nearly 29 per cent of the total output of silver and crude ore shipped to smelters more than 69 per cent.

Of the total silver produced in Arizona in 1931, more than 78 per cent came from ore of the Calumet and Arizona, Magma, Copper Queen branch of the Phelps Dodge Corporation, United Verde, and United Verde Extension mines, each of which produced more than 200,000 ounces of silver. The leading silver-producing districts in Arizona in 1931, in order of output, were the Warren, Pioneer, Verde, Ajo, Harshaw, Tombstone, Globe, and Greenlee.

COPPER

The production of copper in Arizona in 1931 was 401,344,909 pounds—less than any annual output since 1922, and a decrease of nearly 52 per cent from the record output of 830,628,411 pounds in 1929 and of more than 30 per cent from 1930. The output in 1931, however, was more than twice that in 1921, when most of the large copper mines were closed, but it was considerably less than the average annual production (635,600,620 pounds) during the decade 1922 to 1931. From 1904 to 1931, inclusive, the State produced 6,802,602 short tons of copper, and in 1931 the output exceeded the combined output of Montana and Utah (the States next in order) by nearly 66,000,000 pounds. As the average price of copper fell from 13 cents a pound in 1930 to 9.1 cents in 1931, all the large producers of copper curtailed their output to a marked degree and at a number of properties mining was suspended. Unusually large decreases in copper production were recorded in Yavapai, Gila, Cochise, Pinal, Pima, and Greenlee Counties. The largest decreases were made by the United Verde, Miami, United Verde Extension, Nevada Consolidated (Ray mines), Copper Queen branch of the Phelps Dodge Corporation, Calumet and Arizona, Shattuck-Denn, New Cornelia, and Old Dominion properties; each of these decreased its output of copper more than 7,700,000 pounds. The Van Dyke Copper Co., operating property at Miami, was the only large producer of copper that increased its output. Of the total copper produced in the State in 1931, more than 53 per cent was obtained from concentrates, 30 per cent from crude ore smelted, more than 14 per cent from ore leached, and more than 2 per cent from mine-water precipitates.

Nine properties, each yielding more than 24,000,000 pounds, produced nearly 91 per cent of the total copper from Arizona in 1931. The Copper Queen branch of the Phelps Dodge Corporation was first, followed by the Inspiration, Miami, New Cornelia, Morenci branch of the Phelps Dodge Corporation, Calumet and Arizona, Magma, United Verde Extension, and Nevada Consolidated (Ray mines). Other mines that produced more than 2,500,000 pounds of copper each were the United Verde, Old Dominion, Van Dyke, and Christmas. The United Verde mine, the largest producer of copper in Arizona in 1929 and next to the largest in 1930, was closed in May, 1931, and dropped to tenth place. The leading copper-producing districts in Arizona in 1931, in order of output, were the Globe, Warren, Verde, Ajo, Greenlee, Pioneer, Mineral Creek, and Banner.

LEAD

The production of lead in Arizona decreased from 8,491,623 pounds in 1930 to 1,964,112 pounds in 1931, the smallest output in any year since 1904 and only about 12 per cent of the average annual output (15,789,583 pounds) during the decade 1922 to 1931. The 79 mine in Gila County, the largest producer of lead in the State in 1929, and the Montana mine of the Eagle-Picher Lead Co. near Ruby, Santa Cruz County, the largest in 1930, were idle in 1931. Large decreases in output of lead were also reported from the Tombstone Extension (Tombstone Mining Co.), Grand Reef, Blue Bird, Sunrise & Sunshine, Hardshell, World's Fair, and Arizona National properties; however, the output of lead from the Copper Queen property at Bisbee was more than double that in 1930, and the output of lead from the Grand Central tailings dump near Tombstone increased considerably.

The largest producers of lead in Arizona in 1931 were the Copper Queen property of the Phelps Dodge Corporation, Grand Reef, Tombstone Extension (Tombstone Mining Co.), and Grand Central tailings dump; these four properties yielded more than 59 per cent of the total lead output of the State.

ZINC

No zinc was produced in Arizona in 1931 because of the continued drop in metal price; in 1930, 1,630,506 pounds were produced. In the past decade the output has been erratic, ranging from 210,624 pounds in 1922 (none in 1924 and 1931) to 12,946,423 pounds in 1926. The Montana mine of the Eagle-Picher Lead Co. near Ruby, Santa Cruz County, the only large producer of zinc in Arizona from 1928 to 1930, was idle in 1931.

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1930 and 1931, in terms of recovered metals

County	Gold					Silver (lode and placer)	
	Lode		Placer		Total value	Fine ounces	Value
	Fine ounces	Value	Fine ounces	Value			
Cochise	38,760.47	$801,250	35.50	$734	$801,984	1,440,977	$417,883
Gila	3,578.06	73,965	34.05	704	74,669	96,249	27,912
Graham	10.79	223	3.82	79	302	8,937	2,592
Greenlee	2,932.49	60,620	19.79	409	61,029	77,153	22,374
Maricopa	740.33	15,304	55.20	1,141	16,445	2,229	647
Mohave	34,654.25	716,367	9.29	192	716,559	24,332	7,056
Pima	14,568.81	301,164	81.46	1,684	302,848	159,649	46,298
Pinal	8,206.04	169,634	4.70	97	169,731	738,400	214,136
Santa Cruz	110.15	2,277	33.14	685	2,962	130,080	37,723
Yavapai	21,285.39	440,008	583.59	12,064	452,072	565,737	164,064
Yuma	269.93	5,580	208.69	4,314	9,894	1,568	455
	125,116.71	2,586,392	1,069.23	22,103	2,608,495	3,245,311	941,140
Total, 1930	168,758.75	3,488,553	631.63	13,057	3,501,610	5,540,732	2,133,182

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1930 and 1931, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Cochise	95, 435, 951	$8, 684, 672	1, 093, 049	$40, 443			$9, 944, 982
Gila	129, 087, 291	11, 746, 943	49, 030	1, 814			11, 851, 338
Graham	24, 264	2, 208	340, 942	12, 615			17, 717
Greenlee	38, 344, 382	3, 489, 339					3, 572, 742
Maricopa	32, 886	2, 993	49, 423	1, 829			21, 914
Mohave	27, 147	2, 470					726, 085
Pima	41, 209, 532	3, 750, 067	78, 533	2, 906			4, 102, 119
Pinal	52, 560, 077	4, 782, 967	25, 861	957			5, 167, 791
Santa Cruz	40, 767	3, 710	254, 118	9, 402			53, 797
Yavapai	44, 575, 966	4, 056, 413	16, 579	613			4, 673, 162
Yuma	6, 646	605	56, 577	2, 093			13, 047
	401, 344, 909	36, 522, 387	1, 964, 112	72, 672			40, 144, 694
Total, 1930	576, 190, 607	74, 904, 779	8, 491, 623	424, 581	1, 630, 506	$78, 264	81, 042, 416

Ore, old tailings, etc., sold or treated and lode mines producing in Arizona, 1930 and 1931, by counties

County	Ore, old tailings, etc. (short tons)		Lode mines producing		County	Ore, old tailings, etc. (short tons)		Lode mines producing	
	1930	1931	1930	1931		1930	1931	1930	1931
Cochise	1, 994, 220	1, 206, 513	32	20	Pima	2, 375, 974	1, 648, 537	31	28
Coconino	21		2		Pinal	2, 608, 643	1, 536, 702	37	38
Gila	9, 965, 806	7, 510, 422	25	24	Santa Cruz	29, 862	2, 316	36	13
Graham	2, 836	1, 094	5	4	Yavapai	1, 395, 527	431, 174	65	58
Greenlee	1, 379, 915	1, 304, 478	3	2	Yuma	16, 633	481	23	12
Maricopa	3, 647	1, 709	20	26					
Mohave	9, 835	47, 184	22	27		19, 802, 919	13, 690, 610	301	252

MINING INDUSTRY

The year 1931 was largely one of retrenchment for the mining industry of Arizona. No extensive development or improvement campaigns were being conducted in any of the large districts during the year, and the output of ore was curtailed repeatedly until the total value of the metal output was only $10,581,222 more than the $29,563,472 recorded for 1921. The largest decrease was in the Verde district, Yavapai County, due to the closing of the United Verde property in May, the suspension of operations at the adjoining United Verde Extension property for four months, and the idleness of the Verde Central mine throughout the year. These suspensions resulted in a decrease of 73 per cent in value of metal output in the Verde district. The value of the output from the Warren district, Cochise County, declined more than 46 per cent due to the closing of the Copper Queen property in October, the curtailment at the Calumet and Arizona property, and the inactivity at the Shattuck-Denn mine. The value of the output of the Globe district, Gila County, decreased 44 per cent as a result of a 28 per cent curtailment in the output of ore at the property of the Miami Copper Co., a 14 per cent reduction at the Inspiration, and the closing of the Old Dominion property in October. Large decreases in output of ore were also recorded at the Morenci, New Cornelia, Magma, and Nevada Consolidated (Ray mines) properties.

At the end of the year several large copper producers, including the United Verde, Copper Queen, Old Dominion, Verde Central, Christmas, Shattuck-Denn, and Sheldon properties, were idle.

The Montana mine of the Eagle-Picher Lead Co. at Ruby, Santa Cruz County, was idle the entire year; the result was a large decrease in output of both lead and zinc in Arizona in 1931. Inactivity at the 79 mine in Gila County also contributed to the large decrease in production of lead. The only increase of importance recorded in the State in 1931 was in gold ore treated by cyanidation at the Tom Reed mill at Oatman, Mohave County.

There was a substantial increase in the value of the output from Arizona placers in 1931 compared with 1930.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Arizona in 1931, with content in terms of recovered metals

Source	Mines producing	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	158	[1] 58,862	41,032.45	45,470	62,418	7,809	
Dry gold and silver ore	7	9,134	1,922.92	79,931	28,144	590	
Dry silver ore	6	1,690	70.20	108,251	20,465	14,855	
Copper ore	49	[2] 13,606,755	80,684.64	[3] 2,889,868	[4] 401,126,926		
Lead ore	42	[5] 13,951	1,384.19	119,391	91,491	1,873,691	
Copper-lead ore	5	218	22.31	2,243	15,465	67,167	
Total, lode mines	[6] 252	13,690,610	125,116.71	[3] 3,245,154	[4] 401,344,909	1,964,112	
Total, placers	68		1,069.23	157			
	320	13,690,610	126,185.94	[3] 3,245,311	[4] 401,344,909	1,964,112	
Total, 1930	342	19,802,919	[7] 169,390.38	[8] 5,540,732	[9] 576,190,607	8,491,623	1,630,506

[1] Includes 550 tons of old tailings treated by cyanidation and 124 tons of old tailings and 1 ton of old mill cleanings sold to a smelter.

[2] Includes 2,411,954 tons of ore leached and 97 tons of old tailings sold to a smelter.

[3] Includes 137 ounces of silver recovered from precipitates.

[4] Includes 8,881,853 pounds of copper recovered from precipitates.

[5] Includes 9,139 tons of old tailings sold to a smelter.

[6] A mine producing more than one class of ore is counted but once in arriving at total for all classes.

[7] Includes 0.26 ounce of gold recovered from precipitates.

[8] Includes 300 ounces of silver recovered from precipitates.

[9] Includes 12,700,073 pounds of copper recovered from precipitates.

Value of metals from ore, old tailings, etc., sold or treated in Arizona in 1931, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total
Dry gold ore	58,862	$848,216	$13,186	$5,680	$289		$867,371
Dry gold and silver ore	9,134	39,750	23,180	2,561	22		65,513
Dry silver ore	1,690	1,451	31,393	1,862	550		35,256
Copper ore	13,606,755	1,667,900	[1] 838,062	[1] 36,502,550			39,008,512
Lead ore	13,951	28,614	34,624	8,326	69,326		140,890
Copper-lead ore	218	461	650	1,408	2,485		5,004
	13,690,610	2,586,392	[1] 941,095	[1] 36,522,387	72,672		40,122,546
Total, 1930	19,802,919	[2] 3,488,553	[2] 2,133,149	[2] 74,904,779	424,581	$78,264	81,029,326

[1] Includes value of 137 ounces of silver and 8,881,853 pounds of copper recovered from precipitates.

[2] Includes value of 0.26 ounce of gold, 300 ounces of silver, and 12,700,073 pounds of copper recovered from precipitates.

GOLD ORE

Gold ore, old tailings, etc., representing about one-half of 1 per cent of the total output of ore, old tailings, etc., were reported from 154 mines and 4 dumps in 1931. This material, the production of which increased more than 21 per cent over 1930, yielded on the average $14.41 in gold and 0.77 ounce of silver to the ton and a little copper and lead; it was valued at $14.74 in metals a ton. The increase in the output of siliceous gold ore was chiefly the result of the increased output from the property of the Tom Reed Gold Mines Co. at Oatman, Mohave County. In 1931 nearly 74 per cent of the total gold ore, old tailings, etc., came from the Tom Reed property; most of the remainder came from 22 mines and dumps in Mohave County and from 45 mines and dumps in Yavapai County. The quantity of gold ore treated by cyanidation in 1931 was nearly double that in 1930, and there was also a decided increase in the quantity of ore treated by amalgamation. The largest producers of gold ore were the Tom Reed mine at Oatman, Mohave County; the Golden Belt property at Cleator, Yavapai County; the Vulture mine near Wickenburg, Maricopa County; and the United American and Pioneer mines at Oatman, Mohave County.

GOLD AND SILVER ORE

Seven mines in two counties reported the production of gold and silver ore. This material, the production of which increased from 1,822 tons in 1930 to 9,134 tons in 1931, yielded on the average $4.35 in gold and 8.75 ounces of silver to the ton and a little copper and lead; it was valued at $7.17 in metals a ton. The apparent increase in the quantity of gold and silver ore in 1931 was due to the fact that much of the material mined in 1931 contained more silver and was therefore classed as gold and silver ore. Nearly all the gold and silver ore produced in 1931 came from the Bunker Hill and Commonwealth properties in Cochise County.

SILVER ORE

Six mines in four counties reported the output of 1,690 tons of silver ore, a decrease from 3,393 tons produced by 10 mines and 1 tailings dump in 1930. This material yielded on the average 86 cents in gold and 64.05 ounces of silver to the ton, 0.61 per cent copper, and 0.44 per cent lead; it was valued at $20.86 in metals a ton. The World's Fair property near Patagonia, Santa Cruz County, produced nearly 60 per cent of the total output of silver ore in Arizona in 1931; the next largest producer was the Florence property near Ray, Pinal County. The Reymert mine, a large producer of silver ore from 1927 to 1930, was idle in 1931.

COPPER ORE

Of the copper ore and old tailings produced in 1931 at 49 mines and dumps in Arizona, 11,925,443 tons came from 7 low-grade deposits worked by 6 companies whose mines are near Globe, Christmas, Ray, Ajo, Bisbee, and Morenci. The crude copper ore mined and smelted (without concentration) amounted to 1,113,059 tons, of which more than 96 per cent was sulphide material. The total copper ore and old tailings sold or treated in 1931, which represented 99.39 per cent of the total output of ore, etc., in the State, decreased 31 per cent; it yielded on the average 12 cents in gold and 0.212 ounce of silver to the ton and 1.44 per cent copper and was valued at $2.81 in metals a ton compared with $3.95 in 1930. Of the total value of the metal output of the State, metals recovered from copper ore, etc., represented 97 per cent, as follows: Gold 4 per cent, silver 2 per cent, and copper 91 per cent. About 64 per cent of the gold, 89 per cent of the silver, and nearly all the copper produced in Arizona in 1931 came from copper ore, old tailings, etc. The largest producers of copper ore were the Miami, Inspiration, New Cornelia, Nevada Consolidated (Ray mines), Morenci branch of the Phelps Dodge Corporation, Copper Queen branch of the Phelps Dodge Corporation, Old Dominion, Calumet and Arizona, United Verde, and Magma properties. The largest producers of copper ore for direct shipment to a smelter were the Copper Queen branch of the Phelps Dodge Corporation, Calumet and Arizona, United Verde, and United Verde Extension mines.

LEAD ORE

The output of lead ore, etc., decreased from 21,807 tons of ore in 1930 to 13,951 tons of ore and old tailings in 1931. In 1931 this material yielded on the average $2.05 in gold and 8.56 ounces of silver to the ton, 6.72 per cent lead, and 0.33 per cent copper, and was valued at $10.10 in metals a ton. The chief lead mines in Arizona were closed in 1930; they remained idle in 1931 on account of the continued drop in metal prices. More than 65 per cent of the lead material produced in Arizona in 1931 was old tailings from the Grand Central dump near Tombstone, Cochise County; most of the remainder came from 6 mines in Cochise County, 5 mines in Santa Cruz County, and 1 property in Graham County. The chief producers of lead ore were the Grand Reef mine near Aravaipa, Graham County; the Copper Queen property at Bisbee, Cochise County; the World's Fair mine near Patagonia, Santa Cruz County; and the Tombstone Extension property at Tombstone, Cochise County. The 79 mine in Gila County, the largest producer of lead ore in 1930, was idle in 1931; and the output of lead ore from the Tombstone Extension, Sunrise & Sunshine, and Grand Reef mines decreased considerably.

ZINC ORE

No zinc ore was produced in 1930 or 1931 from mines in Arizona.

COPPER-LEAD ORE

Five mines in four counties made the output of 218 tons of copper-lead ore, a decrease from 1,309 tons produced by 14 mines in 1930. In 1931 the ore yielded on the average $2.11 in gold and 10.29 ounces of silver to the ton, 3.55 per cent copper, and 15.41 per cent lead and was valued at $22.95 in metals a ton. More than half of the copper-lead ore came from the Belmont-MacNeill property near Palo Verde, Maricopa County. The concentration plant at this property, for several years the chief producer of copper-lead ore in Arizona, was dismantled, and the output from the mine in 1931 was shipped by a lessee to a smelter.

LEAD-ZINC ORE

No lead-zinc ore was produced in 1931 from mines in Arizona, although 22,701 tons were produced in 1930. No lead-zinc ore has been produced in Arizona since the closing in April, 1930, of the Montana mill of the Eagle-Picher Lead Co. at Ruby, Santa Cruz County.

Ore, old tailings, etc., sold or treated in Arizona in 1931, by counties, with content in terms of recovcred metals[1]

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Cochise	1,043	790.94	1,481	8,107	1,586
Gila	[2] 1,488	1,099.42	1,082	14,072	
Maricopa	1,528	714.23	364	14,738	
Mohave	[3] 46,691	34,605.25	23,656	318	
Pima	1,166	669.16	6,874	965	3,711
Pinal	452	310.35	430	1,981	
Yavapai	[4] 6,083	2,591.23	11,149	21,229	2,512
Yuma	411	251.87	434	1,008	
	58,862	41,032.45	45,470	62,418	7,809
Total, 1930	48,538	33,047.09	65,073	43,726	7,138
DRY GOLD AND SILVER ORE					
Cochise	9,055	1,873.60	77,491	27,901	
Yavapai	79	49.32	2,440	243	590
	9,134	1,922.92	79,931	28,144	590
Total, 1930	1,822	347.53	15,786	3,559	806
DRY SILVER ORE					
Cochise	158	1.00	547	301	
Mohave	40	1.00	214	539	
Pinal	484	26.00	26,585	2,818	
Santa Cruz	1,008	42.20	80,905	16,807	14,855
	1,690	70.20	108,251	20,465	14,855
Total, 1930	3,393	88.84	105,343	16,765	11,736

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[1] No zinc produced in Arizona in 1931. Lead-zinc ore sold or treated in 1930, as follows: 22,701 tons yielding 1,585.57 ounces of gold, 142,440 ounces of silver, 106,624 pounds of copper, 2,021,404 pounds of lead, and 1,630,506 pounds of zinc.

[2] Includes 92 tons of old tailings sold to a smelter.

[3] Includes 550 tons of old tailings treated by cyanidation.

[4] Includes 32 tons of old tailings and 1 ton of old mill cleanings sold to a smelter.

Ore, old tailings, etc., sold or treated in Arizona in 1931, by counties, with content in terms of recovered metals—Continued

COPPER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Cochise	1, 185, 080	34, 847. 10	[5] 1, 306, 029	[5] 95, 345, 245	----------
Gila	[6] 7, 508, 795	2, 456. 62	94, 620	[5] 129, 072, 991	----------
Graham	8	------------	8	897	----------
Greenlee	[7] 1, 304, 478	2, 932. 49	77, 149	[5] 38, 344, 382	----------
Maricopa	55	12. 00	460	8, 766	----------
Mohave	453	48. 00	459	26, 290	----------
Pima	1, 647, 189	13, 877. 14	150, 537	41, 203, 910	----------
Pinal	1, 535, 702	7, 864. 84	[5] 710, 695	[5] 52, 552, 183	----------
Santa Cruz	82	1. 65	59	12, 434	----------
Yavapai	424, 890	18, 626. 74	549, 845	[5] 44, 554, 226	----------
Yuma	23	18. 06	7	5, 602	----------
	13, 606, 755	80, 684. 64	[5] 2, 889, 868	[5] 401, 126, 926	----------
Total, 1930	19, 703, 349	[5] 132, 086. 77	[5] 4, 968, 973	[5] 575, 656, 380	43, 835

LEAD ORE

Cochise	[8] 11, 177	1, 247. 83	55, 422	54, 397	1, 091, 463
Gila	139	22. 02	542	228	49, 030
Graham	1, 086	10. 79	8, 929	23, 367	340, 942
Maricopa	7	1. 10	67	------------	6, 130
Pima	148	17. 00	1, 933	2, 698	62, 401
Pinal	29	3. 05	364	971	18, 908
Santa Cruz	1, 196	64. 30	48, 798	9, 526	234, 763
Yavapai	122	18. 10	2, 238	268	13, 477
Yuma	47	------------	1, 098	36	56, 577
	13, 951	1, 384. 19	119, 391	91, 491	1, 873, 691
Total, 1930	21, 807	1, 243. 15	222, 541	277, 893	5, 781, 614

COPPER-LEAD ORE

Maricopa	119	13. 00	1, 332	9, 382	43, 293
Pima	34	5. 51	288	1, 959	12, 421
Pinal	35	1. 80	323	2, 124	6, 953
Santa Cruz	30	2. 00	300	2, 000	4, 500
	218	22. 31	2, 243	15, 465	67, 167
Total, 1930	1, 309	359. 80	20, 491	85, 660	625, 090

[5] Includes metal recovered from precipitates.
[6] Includes 2,398,628 tons of ore leached.
[7] Includes 13,326 tons of ore leached and 97 tons of old tailings sold to a smelter.
[8] Includes 9,139 tons of old tailings sold to a smelter.

METALLURGIC INDUSTRY

Of the total ore, old tailings, etc., produced in Arizona in 1931, 10,084,563 tons (73.66 per cent) were ore treated by concentration, with subsequent smelting of concentrates; 2,411,954 tons (17.62 per cent) were ore leached, with electrolytic precipitation; 1,144,247 tons (8.36 per cent) were ore, old tailings, etc., shipped to smelters; and 49,846 tons (0.36 per cent) were ore and old tailings treated by amalgamation or cyanidation, chiefly the latter. Compared with 1930 the quantity of ore concentrated decreased nearly 31 per cent, that smelted 45 per cent, and that leached more than 23 per cent, chiefly as a result of the decided decrease in production of copper ore at the large copper properties. There was an increase of more than 24 per cent in material treated at gold and silver mills, chiefly in gold ore from the Tom Reed mine treated by cyanidation but considerably also in ore treated by amalgamation.

Eight smelting plants within the State, all treating copper material, were active during the year; and considerable ore from Arizona was treated at El Paso, Tex. The copper smelter of the Southwest Metals Co. (Sheldon Mining Co.) at Humboldt, rebuilt in 1929 and operated a short time in 1930, was idle in 1931. The lead smelter of the Phelps Dodge Corporation at Douglas has not been operated since early in 1930, and all lead material received at Douglas in 1931 was sent to El Paso, Tex., for smelting. The large copper smelter of the United Verde Copper Co. at Clarkdale was closed in May, and the Clemenceau smelter of the United Verde Extension Mining Co. was idle four months of the year. The smelter of the Magma Copper Co. at Superior was idle during the summer. The remaining five smelters (Phelps Dodge Corporation copper smelters at Douglas and Clifton, Calumet and Arizona at Douglas, International at Miami, and American Smelting & Refining at Hayden) were operated continuously but at a rate decidedly below capacity. At the end of the year the copper smelter of the Phelps Dodge Corporation at Douglas was closed, and all ores, concentrates, etc., were transferred to the adjoining Calumet and Arizona smelter. Early in 1932 most of the smelters were being operated intermittently.

Fifty-six milling plants in Arizona were active in 1931. Twenty-one were concentration plants, of which 5 used gravity machines without flotation equipment, 5 combined gravity and flotation machines, and 11 straight flotation. Gold and silver ore was treated in 35 mills, of which 1 was equipped for amalgamation and flotation, 4 for amalgamation and gravity concentration, 24 for straight amalgamation, 5 for straight cyanidation, and 1 for combined amalgamation and cyanidation. In addition, copper material was treated in 3 leaching plants.

In 1931 the 4,595 tons of ore treated by amalgamation yielded $8.71 in gold and 0.26 ounce of silver to the ton. Ore treated by cyanidation amounted to 44,701 tons; this ore and 550 tons of old tailings yielded $15.49 in gold and 0.52 ounce of silver to the ton. The total value of bullion recovered from ore and old tailings was $748,084 compared with $614,405 in 1930. The increase in 1931 was due to the output of more gold ore from mines near Oatman.

Mine production of metals at gold and silver mills in Arizona in 1931, by counties, in terms of recovered metals

County	Ore and old tailings treated		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Cochise	40				8.60	500
Gila	157		170.53	32		
Maricopa	915		313.13	99		
Mohave	46,066	550	675.25	453	33,886.92	23,123
Pima	727		316.40	488		
Pinal	61		36.81	18		
Yavapai	1,215		324.80	120	8.00	11
Yuma	115		99.47	7		
	49,296	550	1,936.39	1,217	33,903.52	23,634
Total, 1930	24,506	15,612	544.52	276	28,686.77	26,063

Mine production of metals at gold and silver mills in Arizona in 1931, by counties, in terms of recovered metals—Continued

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Maricopa	15	47.00	35	481	--------
Pima	14	74.48	3,277	--------	--------
Yavapai	24	66.40	27	1,626	--------
	53	187.88	3,339	2,107	--------
Total, 1930	12	16.74	82	--------	3,316

There was no important new construction at the larger concentrating plants in Arizona in 1931. Several large concentrating plants and many small plants, active during part of 1930, were idle in 1931; the former include the Bagdad mill near Hillside, the United Verde and the Verde Central mills near Clarkdale and Jerome, the Clara-Swansea mill of the American Smelting & Refining Co. in Yuma County, the mill of the Eagle-Picher Lead Co. at Ruby, and the mill of the Sheldon Mining Co. near Walker. The 400-ton cyanide mill at Congress was also idle. The Christmas mill was closed in May and the Old Dominion and Copper Queen mills in October. The Magma and United Verde Extension mills were idle during the summer. The large Inspiration concentration plant was operated intermittently, chiefly on material for the slimes leaching plant. The rest of the large mills (Miami, Morenci, New Cornelia, and Nevada Consolidated) were operated continuously but at greatly reduced capacity. The large leaching plant at New Cornelia was idle the entire year, and the 9,000-ton vat leaching plant and 600-ton slimes leaching plant at Inspiration operated at reduced capacity.

Data giving original contents of the ores concentrated in Arizona are presented in the following tables which also show the class, quantity, and contents of the concentrates made from each class of ore, by methods of concentration.

Arizona ore[1] *concentrated in 1931, by classes of ore, methods of concentration, and classes of concentrates*[2]

Class of ore concentrated	Method of concentration	Ore concentrated	Gross content of mill feed			
			Gold	Silver	Copper	Lead
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Siliceous gold	Flotation	1,995	664.30	5,592	1,592	8,739
Copper sulphide	do	8,612,641	24,018.00	402,769	187,234,527	--------
		8,614,636	24,682.30	408,361	187,236,119	8,739
Siliceous gold	Gravity and flotation	500	260.00	3,700	300	--------
Copper sulphide	do	1,468,354	9,500.11	623,427	68,611,257	--------
Lead sulphide	do	100	.70	1,880	300	11,400
		1,468,954	9,760.81	629,007	68,611,857	11,400
Siliceous gold	Gravity	[3] 70	68.70	105	70	180
Copper sulphide	do	650	1.33	80	50,090	--------
Lead sulphide	do	253	155.20	1,128	2,015	31,330
		973	225.23	1,313	52,175	31,510
Total		[4] 10,084,563	34,668.34	1,038,681	255,900,151	51,649

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[1] No old tailings reconcentrated in Arizona in 1931.

[2] No zinc produced in Arizona in 1931.

[3] Includes 2 tons of siliceous gold and silver ore.

[4] Figures do not include ore treated at gold and silver mills.

Arizona ore concentrated in 1931, by classes of ore, methods of concentration, and classes of concentrates—Continued

Class of ore concentrated	Method of concentration	Concentrates produced		Gross content of concentrates			
		Class	Quantity	Gold	Silver	Copper	Lead
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Siliceous gold	Flotation	Siliceous gold	213	545.15	4,172	1,262	6,019
Copper sulphide	do	Copper sulphide	350,105	20,325.84	343,606	161,616,541	
			350,318	20,870.99	347,778	161,617,803	6,019
Siliceous gold	Gravity and flotation.	Siliceous gold	51	221.00	3,034	158	
Copper sulphide	do	Copper sulphide (gravity).	50,221	3,046.44	245,953	12,528,546	
		Copper sulphide (flotation).	129,561	5,440.39	331,956	46,566,942	
			179,782	8,486.83	577,909	59,095,488	
Lead sulphide	do	Lead sulphide	13	.40	1,692	142	10,244
			179,846	8,708.23	582,635	59,095,788	10,244
Siliceous gold	Gravity	Siliceous gold	[5] 26	54.57	80	52	130
Copper sulphide	do	Copper sulphide	100	.62	62	38,571	
Lead sulphide	do	Lead sulphide	53	129.43	848	1,140	22,320
			179	184.62	990	39,763	22,450
Total			[6] 530,343	29,763.84	931,403	220,753,354	38,713

[5] Includes 1 ton of siliceous gold and silver concentrates.
[6] Figures do not include concentrates from ore treated at gold and silver mills.

Mine production of metals from concentrating mills in Arizona in 1931, by counties, in terms of recovered metals

County	Ore and old tailings treated		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	579,022		78,959	1,676.00	49,926	20,928,326	18,423	
Gila	5,057,088		95,696	2,368.05	88,487	67,053,689	1,965	
Greenlee	1,279,062		101,261	2,815.00	71,402	35,930,197		
Maricopa	15		6	11.00	4	19		
Mohave	400		57	2.00	430	14,088		
Pima	1,647,368		85,063	13,978.92	152,170	41,195,426	3,290	
Pinal	1,475,496		148,155	6,072.15	522,802	45,051,115		
Yavapai	46,112		21,146	2,840.72	46,182	3,511,731	11,667	
	10,084,563		530,343	29,763.84	931,403	213,684,591	35,345	
Total, 1930	14,556,165	4	[1] 839,300	36,406.70	1,572,171	302,069,159	2,744,176	1,499,700

[1] Includes 1,031 tons of concentrates made from slimes from a leaching plant.

Gross metal content of Arizona concentrates produced in 1931, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	324	951.60	10,591	1,645	6,149	
Copper	530,006	28,870.29	921,611	220,752,603		
Lead	66	129.83	2,540	1,282	32,564	
	530,396	29,951.72	934,742	220,755,530	38,713	
Total, 1930	839,312	36,423.44	1,572,253	313,317,242	3,059,155	1,740,843

Mine production of metals from Arizona concentrates in 1931, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	78,959	1,676.00	49,926	20,928,326	18,423	
Gila	95,696	2,368.05	88,487	67,053,689	1,965	
Greenlee	101,261	2,815.00	71,402	35,930,197		
Maricopa	21	58.00	39	500		
Mohave	57	2.00	430	14,088		
Pima	85,077	14,053.40	155,447	41,195,426	3,290	
Pinal	148,155	6,072.15	522,802	45,051,115		
Yavapai	21,170	2,907.12	46,209	3,513,357	11,667	
	530,396	29,951.72	934,742	213,686,698	35,345	
Total, 1930	839,312	36,423.44	1,572,253	302,069,159	2,747,492	1,499,700

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	324	951.60	10,591	1,532	5,436	
Copper	530,006	28,870.29	921,611	213,684,140		
Lead	66	129.83	2,540	1,026	29,909	

Copper ore constituted 98 per cent of the first-class material smelted. The mines of the Warren district, Cochise County, and those of the Verde district, Yavapai County, together produced more than 88 per cent of the copper ore smelted. Dry and siliceous ore smelted ranked second in quantity and lead ore third. Most of the siliceous ore of smelting grade came from mines in Cochise County and most of the first-class lead ore came from mines in Cochise, Santa Cruz, and Graham Counties.

Gross metal content of Arizona crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Quantity (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	17,150	6,095.10	198,061	115,928	25,881	
Copper	1,113,059	51,871.35	1,968,154	129,581,630		
Lead	4,459	619.56	84,105	66,544	1,830,000	
Copper-lead	218	22.31	2,243	19,332	74,620	
	1,134,886	58,608.32	2,252,563	129,783,434	1,930,501	
Total, 1930	2,062,840	102,765.12	3,927,374	209,229,356	6,472,962	149,202

Mine production of metals from Arizona crude ore shipped to smelters in 1931, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	618, 312	36, 441. 07	1, 357, 668	66, 082, 262	883, 939	----------
Gila	54, 457	1, 006. 48	7, 700	4, 264, 964	47, 065	----------
Graham	1, 094	10. 79	8, 937	24, 264	340, 942	----------
Greenlee	11, 993	117. 49	5, 747	1, 922, 216	----------	----------
Maricopa	779	369. 20	2, 085	32, 386	49, 423	----------
Mohave	168	90. 08	323	13, 059	----------	----------
Pima	442	199. 01	3, 697	14, 106	75, 243	----------
Pinal	61, 145	2, 097. 08	215, 570	7, 476, 962	25, 861	----------
Santa Cruz	2, 316	110. 15	130, 062	40, 767	254, 118	----------
Yavapai	383, 814	17, 996. 51	519, 242	40, 907, 146	4, 912	----------
Yuma	366	170. 46	1, 532	6, 646	56, 577	----------
	1, 134, 886	58, 608. 32	2, 252, 563	120, 784, 778	1, 738, 080	----------
Total, 1930	2, 062, 840	102, 765. 12	3, 927, 374	195, 545, 521	5, 743, 414	130, 806
BY CLASSES OF ORE						
Dry and siliceous	17, 150	6, 095. 10	198, 061	107, 245	17, 818	----------
Copper	1, 113, 059	51, 871. 35	1, 968, 154	120, 608, 824	----------	----------
Lead	4, 459	619. 56	84, 105	53, 244	1, 653, 095	----------
Copper-lead	218	22. 31	2, 243	15, 465	67, 167	----------

Miscellaneous material other than ore and old tailings milled and crude ore smelted consisted of 9,361 tons of old tailings and mill cleanings shipped to a smelter and 2,411,954 tons of copper ore leached; this material yielded 716.76 ounces of gold, 32,861 ounces of silver, 57,991,580 pounds of copper, and 190,687 pounds of lead. Most of the gold and silver and all the lead came from old tailings smelted, and nearly all the copper came from ore leached. In addition, 137 ounces of silver and 8,881,853 pounds of copper were recovered from precipitates.

The 5,000-ton New Cornelia leaching plant at Ajo was idle the entire year, but the 9,000-ton vat leaching plant and the new 600-ton slimes leaching plant at Inspiration were active. Heap leaching was continued in Cochise and Yavapai Counties, and precipitates were also recovered from mine waters at several properties.

REVIEW BY COUNTIES AND DISTRICTS

Notes usually given under the district reviews in this series of reports have been greatly curtailed in an effort to reduce the size of the chapters for 1931. Details on development, notes from printed reports, and statements comparing the production of the current year with that of past years have been omitted unless of unusual importance.

COCHISE COUNTY

Cochise County ranked second in Arizona in 1931 in value of metal output; it was surpassed by Gila County. The production of each of the metals was less in 1931 than in 1930, and there was a marked decrease in copper. The total value of the metals decreased $8,513,197, chiefly because of curtailment in the output of copper at Bisbee. The value of the copper output decreased from $16,692,673 to $8,684,672, gold from $1,000,418 to $801,984, silver from

$697,583 to $417,883, and lead from $67,505 to $40,443; no zinc was produced in Cochise County in 1930 or 1931. Ore of smelting grade (618,312 tons) yielded on the average $11.63 in metals a ton compared with $13.66 in 1930. Of the ore smelted 606,238 tons were classified as copper ore, of which 1,308 tons were estimated to be oxidized ore and 604,930 tons sulphide ore. The lead material consisted of 1,858 tons of first-class ore, 180 tons of milling ore, and 9,139 tons of old tailings. Copper ore of milling grade (578,842 tons) yielded 78,914 tons of copper concentrates. The remainder of the output from Cochise County was siliceous ore, chiefly gold and silver ore shipped for smelting. The placer output amounted to $734 in gold and 7 ounces of silver.

California district.—The only shipment of ore from the California district in 1931 was a test lot of lead ore from the Columbia property near Paradise.

Cochise and Golden Rule districts (*Johnson*, *Dragoon*).—Most of the output from the Cochise and Golden Rule districts in 1931 was sulphide copper ore of smelting grade from the Peabody mine near Dragoon. A test lot of copper ore was shipped from the Centurion property 2 miles north of Dragoon.

Dos Cabezas district.—Three lode mines in the Dos Cabezas district produced 742 tons of ore yielding $11,132 in gold, 2,625 ounces of silver, 4,577 pounds of copper, and 51,687 pounds of lead, valued in all at $14,223, or $19.17 in metals a ton. The output consisted of 474 tons of first-class siliceous gold ore, 88 tons of first-class lead ore, and 180 tons of lead ore of milling grade. Most of the siliceous gold ore was produced from the Dives mine by a lessee. Several cars of siliceous gold ore were shipped from the Gold Prince (Henry Clay) property by the Dos Cabezas Gold Mining Co. All the lead ore and 1 car of siliceous gold ore came from the Le Roy mine, operated by lessees.

Huachuca Mountain district.—Various small placer operations in the Huachuca Mountain district yielded bullion valued at $373, but no ore was marketed from lode mines in 1931.

Swisshelm district (*Webb*, *Elfrida*).—The Four-Horse Mining Co. shipped 3 cars of siliceous gold and silver ore from its Apex mine.

Teviston district.—The Cowboy mine near Willcox was worked a short time in 1931, and a test lot of gold ore of smelting grade was shipped to Douglas. The Apache Chief Placer Mining Co., owning 100 acres of placer ground in Ash Gulch near Willcox, operated its property from January to June and recovered $362 in gold.

Tombstone district.—Four lode mines and one old tailings dump in the Tombstone district produced 15,623 tons of ore and old tailings yielding $45,555 in gold, 101,504 ounces of silver, 62,440 pounds of copper, and 476,814 pounds of lead, valued in all at $98,315, or $6.29 in metals a ton; three lode mines produced metals valued at $118,717 in 1930. Most of the 1931 output was old lead tailings from the Grand Central dump near Fairbank. As in past years the Tombstone property of the Bunker Hill Mines Co. was operated by lessees who shipped about 5,700 tons of siliceous gold and silver ore to Douglas. The Tombstone Extension mine, 2 miles east of Tombstone, was operated by the Tombstone Mining Co., which shipped 300 tons of oxidized lead ore to the smelter at El Paso, Tex. The V. M. P. Leasing Co. continued to operate the Bob Ingersoll mine in 1931 and shipped 257 tons of oxidized lead ore and 36 tons of siliceous gold and silver ore. The remainder of the district output was 158 tons of low-grade silver ore shipped from the Mamie property.

Turquoise district (*Courtland*, *Pearce*, *Gleeson*).—Three lode mines in the Turquoise district produced 3,647 tons of ore, yielding $11,665 in gold, 25,253 ounces of silver, 9,133 pounds of copper, and 59,079 pounds of lead, valued in all at $22,005, or $6.03 in metals a ton. As in recent years, most of the output was siliceous gold and silver ore from the Commonwealth mine of the Commonwealth Mining & Milling Co. at Pearce. In 1931 the property was operated the entire year by the Commonwealth Development Co., which reported shipping 3,047 tons of ore containing 436.53 ounces of gold and 23,356 ounces of silver. The Tejon property near Gleeson was operated by lessees who shipped several cars of oxidized lead ore as well as siliceous gold ore. Two cars of gold ore were shipped from the Golden Crown property near Gleeson.

Warren district (*Bisbee*, *Lowell*, *Warren*, *Don Luis*).—Four lode mines in the Warren district produced 1,186,213 tons of ore, which, with copper precipitates, yielded $731,888 in gold, 1,309,398 ounces of silver, 95,327,922 pounds of copper, and 503,242 pounds of lead, valued in all at $9,805,074; the ore yielded on the average $7.62 in metals a ton. The decrease of 32,571,796 pounds in copper resulted from the general curtailment in the district. The output of the district in 1931 consisted of 578,842 tons of milling ore which was reduced to 78,914 tons of concentrates and of 607,371 tons of first-class smelting ore. The total metal output included considerable copper and a little silver from mine-water precipitates and from heap leaching.

On October 1, 1931, the Phelps Dodge Corporation acquired the assets and liabilities of the Calumet and Arizona Mining Co. Prior to the consolidation the Copper Queen branch was operated at a reduced rate by the Phelps Dodge Corporation, and the output from the mines of the Calumet and Arizona Mining Co. was also greatly reduced. After the consolidation further curtailment necessitated the closing of the Copper Queen branch, and during the last quarter of the year only the Campbell and Junction units (formerly owned by the Calumet and Arizona Mining Co.) were being operated. Production of copper ore of concentrating grade from the Sacramento division was suspended early in October, and the 4,000-ton flotation plant at Don Luis was closed. The 2,300-ton copper-smelting plant at Douglas (Copper Queen smelter), owned by the Phelps Dodge Corporation, was operated at limited capacity until the end of the year, when receipts of smelting material were so reduced that only one smelting plant was required. Work at the Copper Queen plant was therefore suspended, and early in 1932 all smelting was done at the plant near Douglas acquired from the Calumet and Arizona Mining Co. No printed annual report for 1931 was issued by the Calumet and Arizona Mining Co., and production figures given in the report of the Phelps Dodge Corporation represent a consolidated statement of production from all branches of the corporation. The output of copper in 1931 from the consolidated properties at

Bisbee decreased nearly 19 per cent from that in 1930, silver nearly 15 per cent, and gold nearly 14 per cent.

Development at the Copper Queen branch during 1931, including development of the Calumet and Arizona property from October 1 to December 31, consisted of 28,077 feet of drifts, raises, and miscellaneous work and 6,806 feet of diamond drilling. From January 1 to September 30, 1931, the Calumet and Arizona Mining Co. did 21,208 feet of drifting, 7,754 feet of raising, and 122 feet of diamond drilling. According to the printed report of the Phelps Dodge Corporation for 1931, prior to the consolidation the Calumet and Arizona Mining Co. paid a dividend of $2.50 a share ($2,093,850 in all), making a total of $77,583,010 paid to stockholders since its organization in 1903. Two dividends were paid by the Phelps Dodge Corporation, one of 50 cents a share on April 1 and another of 25 cents a share on July 1, a total distribution of $2,117,042 for the year. Total production from all mines of the Phelps Dodge Corporation, including property in Mexico, and from all properties of the Calumet and Arizona Mining Co., including property in New Mexico, was 208,128,169 pounds of copper, 4,128,671 ounces of silver, 90,720 ounces of gold, and 543,359 pounds of lead. Production from custom material smelted at Douglas was 954,526 pounds of copper, 1,135,484 ounces of silver, 9,029 ounces of gold, and 3,217,205 pounds of lead. The Copper Queen property was the largest producer of copper and lead in Arizona in 1931, ranked second in production of gold, and was third in silver. The Calumet and Arizona property was the largest producer of silver, ranked third in production of gold, and was sixth in copper.

The Shattuck-Denn Mining Corporation produced no ore from its properties in 1931. Lessees, however, operating parts of the Shattuck mine, shipped 327 tons of gold ore and 50 tons of copper ore to Douglas for smelting.

The Night Hawk property of the Phelps Dodge Corporation was operated in 1931 by lessees who shipped several thousand tons of copper ore to Douglas for smelting. The production is included in the report of the Copper Queen branch of the Phelps Dodge Corporation.

The Broken Promise claim of the Wolverine & Arizona Mining Co. was also under lease; shipments to Douglas consisted of nearly 1,300 tons of first-class copper ore.

GILA COUNTY

In 1931 Gila County again ranked first in the State in value of metal output, with a yield of more than 32 per cent of the total copper produced. Operators reported 7,510,422 tons of ore and old tailings from 24 lode mines sold or treated in 1931, compared with 9,965,806 tons of ore from 25 lode mines in 1930. Including placer output, gold decreased from $122,868 to $74,669, silver from 219,998 to 96,249 fine ounces, copper from 165,776,725 to 129,087,291 pounds, and lead from 1,906,290 to 49,030 pounds. The decrease in total value of the four metals from $21,853,856 in 1930 to $11,851,338 in 1931 was due chiefly to the marked curtailment in the output of copper ore from mines near Globe and Miami. Nearly all (7,508,795 tons) of the output from the county was classified as copper material, of which 5,057,018 tons were concentrated; the resulting concentrates—95,689 tons—yielded 2,349.43 ounces of gold, 88,284 ounces of silver, and 67,053,560 pounds of copper. The remainder of the county output consisted of 1,488 tons of siliceous gold ore and old tailings and 139 tons of lead ore.

Banner district.—Seven lode mines in the Banner district (Gila County) produced 80,119 tons of ore yielding $23,267 in gold, 18,311 ounces of silver, and 2,606,132 pounds of copper, valued in all at $265,735, or $3.32 in metals a ton. The output decreased considerably from that in 1930, when five lode mines produced 223,848 tons of ore yielding metals valued at $1,134,325. As in 1930, the largest producer in the district was the Christmas Copper Co. (controlled by the Iron Cap Copper Co.). The mine and 400-ton flotation plant were operated regularly the first 4 months of the year; then the mill was closed, and the mine output was limited to shipments of first-class smelting ore. The production of copper by the company in 1931 decreased nearly 65 per cent from that in 1930. The company reported[3] a production of 60,786 tons of mill ore containing 1.971 per cent copper, treated in the flotation plant at a cost of 62 cents a ton. The resulting concentrates, together with 18,323 tons of crude smelting ore containing 2.31 per cent copper, were shipped to Hayden for smelting. The Iron Cap Copper Co. reported the production of 2,447,780 pounds of copper, 9,530 ounces of silver, and 301 ounces of gold from the Christmas mine.

The Columbia group, owned by the Dripping Springs Mines Consolidated, was operated by a lessee who shipped 763 tons of siliceous gold ore. Siliceous gold ore was also shipped from the Apex, Baby & Ramona, La Palma, and Standard properties.

Globe district (*Miami*, *Inspiration*).—In 1931, 13 lode mines and 5 placers in the Globe district produced 7,429,571 tons of ore and old tailings, $50,869 in gold, 77,670 ounces of silver, 126,443,616 pounds of copper, and 47,065 pounds of lead, valued in all at $11,581,503. The ore and old tailings yielded on the average $1.56 in metals a ton. In 1930, 16 lode mines produced 9,740,546 tons of ore yielding metals valued at $20,702,756. In 1931 most of the ore (4,995,582 tons) was concentrated and yielded 91,117 tons of concentrates which, with 35,124 tons of crude ore and 92 tons of old tailings, were shipped for smelting.

The largest output in the district came from the Miami mine, which produced 4,438,808 tons of copper ore; the Inspiration mine followed, with 2,620,908 tons; and considerable ore was also mined at the Old Dominion and Van Dyke mines.

From the Inspiration property[4] 61,368,033 pounds of copper were produced during 1931—2,742,647 pounds from ore concentrated, 54,822,713 pounds from ore leached, 875,680 pounds from leaching-plant slimes concentrated, and 2,926,993 pounds from leaching-plant slimes leached. Compared with 1930 the output of copper decreased 4,238,631 pounds, chiefly from ore concentrated, as the flotation plant was idle nearly all year. The property ranked second as a producer of copper in Arizona in 1931. The total ore mined and treated (2,620,908 tons) averaged 1.335 per cent copper; the concentrating ores averaged 1.932 per cent and the leaching ores 1.313 per cent. The mining of sulphide ore of concentrating grade was suspended in May, 1930, and the 18,000-ton flotation plant has been idle nearly the entire intervening time. Ore of this class produced by development and necessary stoping, which was treated at the concentrator during 1931, amounted to 78,558 tons. One section of the concentrator was used in treating primary slime from the leaching plant. Operations at the vat leaching plant, which has a daily capacity of 9,000 tons, were continuous during the year but at a reduced rate. The slimes-treatment plant, which was placed in operation in May, 1930, was operated continuously during 1931. The over-all extraction of copper was a little lower than in 1930, due chiefly to the increased sulphide copper content of the material treated in the main leaching vats. The cost of fine copper produced, including depreciation but excluding depletion and Federal taxes, was 8.4288 cents a pound compared with 9.6671 cents in 1930. No dividends were paid during 1931; total distributions to stockholders to the end of 1931 have amounted to $53,167,304. Income from sale of copper in 1931 was $3,609,983. After expenses were deducted for mining, development, reduction, refining, selling, administration, Federal taxes, and changes in copper inventory the profit was $79,828. After depreciation and interest and discount on indebtedness were deducted the net loss was $492,522; the surplus on December 31, 1931, was $6,981,182.

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[3] Iron Cap Copper Co. Ann. Rept. for 1931.
[4] Inspiration Consolidated Copper Co. Ann. Rept. for 1931.

The Miami Copper Co., according to its annual printed report, produced 50,572,571 pounds of refined copper from 4,438,808 tons of milling ore at a cost of 9.927 cents a pound. This output was 16,552,025 pounds (nearly 25 per cent) less than that in 1930. The mine and mill were operated continuously in 1931, but two of the six sections of the concentrator were idle the entire year. The property ranked third as a producer of copper in Arizona in 1931 and has in reserve 79,884,325 tons of sulphide ore averaging 0.88 per cent copper and 7,000,000 tons of mixed ore averaging 1.83 per cent copper. Development in 1931 totaled 33,101 feet, comprising 20,274 feet of drifts, crosscuts, and stations, 12,434 feet of raises, and 393 feet of shaft sinking. The concentrator operated 354 days and treated an average of 12,539 tons of ore a day for the period. The ore treated contained on the average 0.696 per cent copper; 0.599 per cent was sulphide compared with 0.604 per cent in 1930. From 4,438,808 tons of ore milled 63,767 tons of concentrates were produced, averaging 40.881 per cent copper, a recovery of 84.40 per cent of the total copper. The ratio of concentration was 69.6 tons to 1. No dividends were paid in 1931; total distributions paid to stockholders since May 15, 1912, have amounted to $37,332,623. The operating revenue for 1931 was $4,394,231; after all operating expenses except depreciation were deducted the loss was $626,139. After allowances were made for depreciation the net loss carried to surplus was $951,024; the earned surplus at the end of the year was $7,080,070.

The property of the Old Dominion Co. at Globe was closed on October 14, 1931. In 1931, prior to the shutdown, the mine produced 334,494 tons of copper ore, which was treated in the company

1,700-ton flotation plant. The concentrates, with a little first-class smelting ore, were shipped to Miami for smelting. The refined copper produced from this ore was 11,347,711 pounds compared with 17,596,795 pounds in 1930. Dividends amounting to $14,405,260 were paid to stockholders from December 15, 1905, to December 31, 1918, but none since. The total income for the year was $644,174; after all expenses, including depreciation, were deducted the net loss was $620,935. After allowance for depletion the deficit at the close of the year was $673,177.

The Van Dyke Copper Co. operated the Van Dyke property near Miami the entire year and shipped more than 34,000 tons of oxidized copper ore to the International smelter at Miami; the company increased its output of copper 57 per cent over that in 1930. A 25-ton amalgamation plant was erected at the Last Hope (Moran & Slotkey) property, 125 tons of gold ore were treated during the summer, and bullion valued at nearly $3,200 was shipped to San Francisco, Calif.; in addition to the ore milled, about 230 tons of gold ore and old tailings were shipped to Miami for smelting.

The remainder of the district output consisted of gold ore from the Pine Tree, Whelan & Smith, Lyon, Savage, and S. O. S. T. groups; oxidized copper ore from the High Line and Superior & Boston mines; and oxidized lead ore from the New Dominion group. Five placers in the district produced gold valued at $704; most of it came from Lost Gulch, west of Miami.

Green Valley district.—Small lots of gold ore from the Gold Bond and Columbia properties were treated by amalgamation.

Summit district.—The Gibson group of the Bellevue Copper Co. was operated by lessees who treated several hundred tons of sulphide copper ore in a 25-ton table concentration plant and shipped 100 tons of concentrates to Miami for smelting.

Young district.—The Spring Creek property near Young was idle in 1931, but a small quantity of lead concentrates produced in 1930 was shipped early in 1931.

GRAHAM COUNTY

One placer and four lode mines in Graham County produced 1,094 tons of ore, $302 in gold, 8,937 ounces of silver, 24,264 pounds of copper, and 340,942 pounds of lead, valued in all at $17,717, compared with $57,237 from one placer and five lode mines in 1930. Most of the output, as in 1930, was first-class oxidized lead ore from the Grand Reef mine near Klondyke.

Aravaipa district.—Three lode mines in the Aravaipa district produced 1,086 tons of ore, yielding $223 in gold, 8,929 ounces of silver, 23,367 pounds of copper, and 340,942 pounds of lead, valued in all at $17,554, or $16.16 in metals a ton. All the output was oxidized lead ore of smelting grade, chiefly from the Grand Reef mine, 3 miles north of Klondyke. The property ranked second as a producer of lead in Arizona in 1931, although its output was less than half of that in 1930. First-class lead ore was also shipped from two properties near Aravaipa.

Lone Star district.—A test lot of copper ore was shipped from the Morning Star property, and a little placer gold was marketed from a prospect near Safford.

GREENLEE COUNTY

The total value of the metal output in Greenlee County decreased from $5,720,971 in 1930 to $3,572,742 in 1931. The output was chiefly copper ore from the Morenci property of the Phelps Dodge Corporation. The output of copper decreased 11 per cent (4,799,662 pounds); the value of the total output of metals decreased more than 37 per cent on account of the lower metal prices and the general curtailment at the mines and smelter at Morenci and Clifton.

Copper Mountain and Greenlee districts (*Morenci*, *Metcalf*, *Clifton*).—The output of the Copper Mountain and Greenlee districts was chiefly copper ore from the Morenci property of the Phelps Dodge Corporation. The company operated its mine 248 days, the 5,500-ton concentrator 251 days, and the smelter at Clifton 259 days. Most of the ore mined was treated in the combined gravity and flotation concentrator at Morenci; and the concentrates, together with several thousand tons of crude copper ore and copper precipitates, were reduced to blister copper at the Clifton smelter. The annual report of the Phelps Dodge Corporation for 1931 did not give the tons of ore mined or the contents of the blister copper produced, but the output of copper in 1931 was nearly 11 per cent less than that in 1930 and more than 31 per cent less than that in 1929. Late in the fall a statement was made in the press that production had been limited to about 3,000,000 pounds of copper a month. Most of the smelter output was marketed as fire-refined copper ingots and the remainder as copper anodes shipped to El Paso, Tex., for refining. In addition to operating its mill and smelter the company also operated a 150-ton testing plant designed to do experimental work on ore from the new Clay ore body by flotation or leaching, or by a combination of the two. The company reported 19,177 feet of development in drifts, raises, and winzes during 1931.

The only other production from the Copper Mountain and Greenlee districts in 1931 was 1 car of sulphide copper ore from the Bianes & Pitts group.

San Francisco River district.—Three placers in the San Francisco River district produced $409 in gold and 4 ounces of silver.

MARICOPA COUNTY

Five placers and 26 lode mines in Maricopa County produced 1,709 tons of ore, $16,445 in gold, 2,229 ounces of silver, 32,886 pounds of copper, and 49,423 pounds of lead, valued in all at $21,914, compared with $84,061 from 3 placers and 20 lode mines in 1930. More than half (915 tons) of the total output in 1931 was ore treated by amalgamation or amalgamation and concentration; it yielded by amalgamation gold and silver valued together at $6,502. First-class smelting ore amounted to 779 tons and yielded metals valued at $13,013. A small quantity of ore was concentrated; the resulting concentrates together with those from ore treated by amalgamation and concentration yielded metals valued at $1,256. Placer bullion was valued at $1,143.

Big Horn district.—Lessees operating the Alaskan mine on the east side of the Harqua Hala Mountains south of Aguila shipped about 400 tons of gold ore to the smelter at Hayden.

Cave Creek district.—Six lode mines in the Cave Creek district produced 106 tons of ore yielding $2,158 in gold, 135 ounces of silver, and 2,760 pounds of copper, valued in all at $2,448, or $23.09 in metals a ton. Exceptionally rich gold ore from the Lucky Gus mine was treated in a small amalgamation and concentration plant and yielded metals valued at nearly $700; 60 tons of gold ore from the Rackensack mine were treated by amalgamation in the Richardson mill near Cavecreek; 1 car of oxidized copper ore was shipped from the Mormon Girl property of the Lewis Investment Co.; and small lots of gold ore were produced from three prospects near Cavecreek.

Hassayampa River district.—A small quantity of gold bullion was marketed from placer operations on the Hassayampa River near Wickenburg.

Midway (*Saddle Mountain*) *district.*—One car of siliceous gold ore from the Amarilla property 20 miles northwest of Dixie was shipped to the smelter at Hayden.

New River district.—A test lot of oxidized copper ore was shipped from the Daisy mine and a small quantity of gold ore from the Ellis claim.

Pikes Peak (*White Butte*) *district.*—A test lot of gold ore from the Godfred group 33 miles north of Phoenix was shipped to Hayden for smelting.

San Domingo district.—Three placers in the San Domingo district produced $937 in gold and 6 ounces of silver. The gold was recovered by dry washing in San Domingo Wash near Morristown.

Vulture district.—One placer and eight lode mines in the Vulture district produced 1,113 tons of ore, $8,796 in gold, 1,827 ounces of silver, 15,815 pounds of copper, and 43,293 pounds of lead, valued in all at $12,367. The ore had an average value of $10.99 in metals a ton. Most of the output in 1931 was low-grade gold ore from the Vulture mine treated by amalgamation and concentration. The property was under option to the United Verde Extension Mining Co., which did extensive diamond drilling and completed the new vertical shaft to a depth of 509 feet. No commercial ore was developed, however, and operations were suspended in September. The upper part of the old workings of the Vulture mine, together with the surface dumps, were operated during the last 3 months of the year by lessees who treated 823 tons of low-grade gold ore in a 25-ton amalgamation and gravity concentration mill; the resulting gold bullion and concentrates yielded metals valued at about $5,500. In addition to the ore milled lessees shipped several small cars of gold ore to Hayden for smelting. In 1931 the Belmont-MacNeill property of the Tonopah Belmont Development Co. was operated by lessees who shipped several cars of first-class copper-lead ore to El Paso, Tex., and 1 car of copper ore to Hayden, Ariz. The remainder of the district output consisted of siliceous gold ore from the Golden Harp, Sunrise, and Gold Spot properties and from two prospects and a test lot of copper ore from the Happy Days claim. The placer output, valued at $134, came from the Ventura property.

White Peak district.—A small quantity of oxidized lead ore from a prospect in the White Peak district was shipped to the smelter at El Paso, Tex.

White Picacho district.—A test lot of copper ore from the Another Chance group 13 miles east of Morristown was shipped to the smelter at Hayden.

Winifred district.—Four lode mines in the Winifred district produced 35 tons of ore yielding $574 in gold, 8 ounces of silver, and 94 pounds of copper, valued in all at $585, or $16.71 in metals a ton. The output consisted of a small quantity of gold ore from the Union mine 20 miles north of Phoenix treated in a concentration mill and of test lots of gold ore and copper ore from three prospects.

MOHAVE COUNTY

In Mohave County 26 lode mines and 1 old tailings dump produced 47,184 tons of ore and old tailings, an increase of 17,349 tons over the output of 20 lode mines and 2 dumps in 1930. There was also 1 producer of placer gold in 1931. The total output of gold increased from $594,011 to $716,559; that of silver decreased from 25,942 to 24,332 fine ounces; and that of copper increased from 2,617 to 27,147 pounds. The total value of the metal output increased from $607,906 to $726,085. No lead or zinc was produced in Mohave County in 1931, although 37,640 pounds of lead and 35,104 pounds of zinc were produced in 1930. Mohave County was the only one in Arizona in which the total value of metal output increased in 1931. As in 1930 the increase was due almost entirely to the large production of gold from the Tom Reed property at Oatman.

Most of the ore (44,644 tons) in the county was treated by cyanidation and with 550 tons of old tailings cyanided yielded $700,505 in gold and 23,123 ounces of silver, valued together at $707,210; the ore and old tailings averaged $15.65 in metals a ton. Ore treated by amalgamation (1,422 tons) had a total value in gold and silver of $14,090; crude ore shipped to smelters (168 tons) had a total value in metals of $3,144; and concentrating ores (400 tons) yielded 57 tons of concentrates which had a total value in metals of $1,448. The placer output was valued at $193.

Bentley district.—Two small lots of oxidized copper ore from the Chief (Grand Gulch) property were shipped to Garfield, Utah, for smelting.

Cedar Valley district.—In 1931 the Boriana Mining Co., controlled by Stoody Co. of Whittier, Calif., operated the old Yucca Tungsten property 18 miles northeast of Yucca and treated several hundred tons of copper-tungsten ore in a combined gravity and flotation plant. One car of tungsten concentrates was shipped to New York City, and 1 car of copper concentrates was shipped to Douglas, Ariz. During the World War the operators of the Yucca Tungsten property shipped several hundred tons of rich tungsten concentrates to eastern refineries.

Chemehuevis district.—One placer and 5 lode mines in the Chemehuevis district produced 75 tons of ore, $1,137 in gold, and 17 ounces of silver, valued together at $1,142; the ore had an average value of $12.65 in metals a ton. The placer output, valued at $193, was recovered by dry washing of gravels from old diggings in the Chemehuevis Mountains. The output from lode mines (Dutch Flat, Gold Wing, Owl, Santa Claus, and Wandell) was all gold ore treated by amalgamation or cyanidation. The largest producer in the district in 1931 was the Dutch Flat group.

Indian Secret district.—A small quantity of gold ore from the Last Chance mine 75 miles north of Kingman was treated by amalgamation, and bullion valued at about $200 was shipped to San Francisco, Calif.

Music Mountain district.—The new 20-ton amalgamation and cyanidation mill of the Portland & Mizpah Mining Co. 23 miles north of Hackberry was operated a short time in 1931 and treated 500 tons of ore, including some dump material. Gold and silver, valued at nearly $4,000, from bullion and cyanide precipitates were marketed.

Owens (*McCracken and Potts Mountains*) *district.*—One car of oxidized copper ore from the Brooklyn property 15 miles southwest of Signal was shipped to Hayden for smelting.

San Francisco district (*Oatman*, *Gold Road*, *Vivian*).—Eleven lode mines in the San Francisco district produced 45,414 tons of ore yielding $706,767 in gold, 21,771 ounces of silver, and 276 pounds of copper, valued in all at $713,106, or $15.70 in metals a ton. In 1930, 11 lode mines produced 28,048 tons of ore and old tailings yielding metals valued at $587,803. The Tom Reed Gold Mines Co. was as usual the chief producer in the district. Its mine at Oatman was operated continuously during the year, and its 250-ton all-slime cyanidation plant treated 43,436 tons of gold ore from the company mine and 1,166 tons from mines in the vicinity—a total of 44,602 tons compared with 22,952 tons in 1930. Bullion was shipped to the San Francisco Mint at an average rate of more than $58,000 a month. The Tom Reed mine is opened to a depth of 1,100 feet by a vertical shaft, and in 1931 the company reported 3,348 feet of development. Four quarterly dividends aggregating $240,000 were paid to stockholders during the year, the first payments since 1927, which raised the total disbursements of the company to $3,334,215. The property was the largest producer of gold in Arizona in 1931, and its increased output resulted in a decided increase in the total value of the metal output in Mohave County. The Pioneer mine was operated by the Pioneer Consolidated Mines Co. and by several lessees. The ore mined by the company was treated in a 30-ton amalgamation mill on the property, and the lease ore was hauled to the Tom Reed cyanidation mill; more than 800 tons of gold ore were treated. The United American mine adjoining the Tom Reed property was operated by lessees, and nearly 900 tons of gold ore were treated in the Tom Reed mill. Late in the year it was reported that the Tom Reed Gold Mines Co. had taken a 5-year lease on the mine and that development would be undertaken from levels of the Tom Reed mine. Other producers of gold ore near Oatman were the Big Jim, Sunnyside, Telluride, Storm Cloud, Keystone Wedge, Tin Cup (Loftus), Gold Center, and Atlas properties.

Union Pass district.—A lessee re-treated about 550 tons of old tailings from the dumps of the Katherine Gold Mining Co., 33 miles west of Kingman; bullion valued at about $2,600 was marketed.

Wallapai district (*Cerbat*, *Chloride*, *Kingman*, *Mineral Park*, *Stockton Hill*).—Three lode mines in the Wallapai district produced 103 tons of ore yielding $328 in gold, 253 ounces of silver, and 581 pounds of copper, valued in all at $454, or $4.41 in metals a ton. In 1930 the total value of the district output was $7,620. The output in 1931 consisted of 1 car of siliceous silver ore from the Hard Times mine and siliceous gold ore from the Jack Pot and Tintic mines.

Weaver district.—The Chloride Consolidated Mines Co. reconditioned the 50-ton amalgamation mill at the Dixie Queen-Virginia group 25 miles northwest of Chloride and late in the year started milling gold ore; bullion valued at about $700 was sent to the San Francisco Mint. The Mohave Gold Mining Co., organized in 1931 to develop the Farr claims 30 miles northwest of Chloride, did 100 feet of shaft work and 460 feet of crosscuts; a test lot of gold ore was treated at the Tom Reed cyanidation plant.

PIMA COUNTY

In 1931 the total value of the metal output in Pima County was $4,102,119, a decrease of $2,803,303 from the total value in 1930. The decline was due chiefly to the unusual drop in the output of copper—from 50,600,212 to 41,209,532 pounds and from $6,578,028 to $3,750,067. Gold increased from $247,526 to $302,848 and silver from 136,574 to 159,649 fine ounces; lead decreased from 545,735 to 78,533 pounds. The output of ore, etc., decreased from 2,375,974 to 1,648,537 tons. Concentrating ores (1,647,368 tons) yielded 85,063 tons of concentrates—nearly all copper concentrates from Ajo—which had a total value in metals of $4,082,005, compared with $5,786,731 in 1930. Ore of shipping grade aggregated 442 tons and yielded metals valued at $9,254. Nearly all the remainder of the ore (700 tons) was gold ore treated by amalgamation and concentration. The placer output amounted to $1,684 in gold and 17 ounces of silver.

Ajo district.—All the output of the Ajo district was from the New Cornelia property. The output of copper was nearly 18 per cent less than in 1930, but there was a good increase in the output of both gold and silver. The property ranked fourth as a producer of copper and gold in Arizona in 1931 and sixth as a producer of silver. The New Cornelia property, formerly operated by the New Cornelia Copper Co., was acquired by the Calumet and Arizona Mining Co. in April, 1929, and became part of the reorganized Phelps Dodge Corporation on October 1, 1931. Both carbonate and sulphide copper ores have been produced from the large open-pit mine at Ajo. The sulphide ore is treated in a large flotation plant, and the carbonate ore was treated in a 5,000-ton leaching plant. The entire mine output since the leaching plant was closed on July 2, 1930, has been sulphide copper ore treated in the flotation plant. The addition in 1930 of three units to the flotation plant raised its capacity to about 15,000 tons a day. In 1931 the enlarged flotation plant was operated at about 30 per cent of maximum capacity. Stockholders of the New Cornelia Copper Co. were paid dividends amounting to $18,630,000 from 1918 to February, 1929. From the latter date to October 1, 1931, dividends from the profits of New Cornelia operations were included with those paid by the Calumet and Arizona Mining Co.; and since October 1, 1931, they have been included with the payments of the Phelps Dodge Corporation. Dividend payments, profit and loss statements, and mining and milling data for the New Cornelia branch were not printed separately in 1931 but were included in the general report of the Phelps Dodge Corporation for the year ended December 31, 1931.

Arivaca district.—One placer and seven lode mines in the Arivaca district produced 87 tons of ore, $1,554 in gold, 462 ounces of silver, 1,114 pounds of copper, and 2,009 pounds of lead, valued in all at $1,863. The ore had an average value of $20.24 in metals a ton. Most of the output was siliceous gold ore and copper-lead ore of smelting grade from the Fairplay property near Arivaca. The Arivaca King claim of the Calzona Mining Co. was operated by a lessee who shipped 1 car of low-grade gold ore to El Paso, Tex. The remainder of the district output comprised test lots of oxidized lead ore from the Jean Louise and Lincoln claims; gold ore from the Los Guijas, Zepada, and Yellow Jacket properties; and placer gold valued at $102 from a prospect near Arivaca.

Baboquivari district.—Three lode mines in the Baboquivari district produced 993 tons of ore yielding $9,856 in gold, 6,363 ounces of silver, 263 pounds of copper, and 3,436 pounds of lead, valued in all at $11,852, or $11.94 in metals a ton. The output was chiefly siliceous gold ore from the Allison (Chance) group 72 miles southwest of Tucson, operated under lease by the El Oro Mining & Milling Co. More than 700 tons of gold ore were treated by amalgamation and concentration; bullion valued at nearly $5,500 was sent to San Francisco, Calif., and 14 tons of concentrates containing 5.32 ounces of gold and 234 ounces of silver to the ton were shipped to Hayden, Ariz. The Jupiter mine was operated by the Arizona Jupiter Mines Co., and several hundred tons of siliceous gold ore were treated in a small flotation plant; the resulting concentrates, together with 1 car of first-class smelting ore, were shipped to El Paso, Tex. A test lot of gold ore was produced from a prospect in the Baboquivari Mountains.

Cababi district (*Comobabi*).—Four lode mines in the Cababi district produced 21 tons of ore yielding $703 in gold, 64 ounces of silver, 18 pounds of copper, and 301 pounds of lead, valued in all at $734, or $34.95 in metals a ton. Small lots of rich gold ore were produced from the Jaeger, High Card, and Sajura claims, all near Sells, and a test lot of lead ore was produced from the Easterday claim.

Empire district.—From the Chief and Jerome No. 2 claims of the State of Maine group, the only producers in the Empire district in 1931, 62 tons of oxidized lead ore were shipped, yielding metals valued at $1,367. Five lode mines produced metals valued at $10,254 in 1930.

Greaterville district.—The entire output of the Greaterville district ($1,530 in gold and 17 ounces of silver) came from placers. Most of the gold is sold to storekeepers at Greaterville.

Helvetia district.—A lessee operating part of the Rosemont group shipped 1 car of first-class copper ore to the smelter at Hayden. All the other mines in the Helvetia district were idle in 1931, and the output decreased considerably from that in 1930 when 3 mines produced 2,258 tons of ore yielding metals valued at $19,648.

Papago district.—One car of high-grade oxidized lead ore from the Sunshine & Sunrise property was shipped by the Shafer Mining & Milling Co. The output in 1931 was much less than that in 1930 as the milling plant was idle.

Pima district (*Olive*, *San Xavier*, *Helmet Peak*, *Twin Buttes*).—Four lode mines in the Pima district produced 85 tons of ore yielding $191 in gold, 1,238 ounces of silver, 2,053 pounds of copper, and 26,393 pounds of lead, valued in all at $1,714, or $20.16 in metals a ton. The output was all first-class oxidized lead ore and copper-lead ore of smelting grade. Lead ore was shipped from the High Hill, Ant Hill, and Simmons properties and copper-lead ore from the Hoosier-Marjorie group.

Quijotoa district.—Three lode mines in the Quijotoa district produced 72 tons of ore yielding $1,785 in gold, 118 ounces of silver, and 173 pounds of copper, valued in all at $1,835, or $25.49 in metals a ton. Nearly all the output was first-class siliceous gold ore of smelting grade from the Morgan and Mocking Bird properties near Covered Wells.

Santa Catalina district.—The output of the Santa Catalina district consisted of a small quantity of gold ore and a little placer gold from prospects.

Silver Bell district.—In 1931 the output of the Silver Bell district comprised 2 cars of low-grade oxidized copper ore from the property of the Twin Cactus Mining Co. In 1930 the metal output of the district was valued at $29,790 and in 1929 at $431,487. Both the El Tiro and Imperial mines, formerly large producers, were idle in 1931.

PINAL COUNTY

In Pinal County 38 lode mines produced 1,536,702 tons of ore, a decrease of 1,071,941 tons from the output of 37 lode mines in 1930. Gold decreased from $184,238 to $169,731, silver from 989,837 to 738,400 fine ounces, copper from 68,761,598 to 52,560,077 pounds, and lead from 738,364 to 25,861 pounds. The total value of the metals decreased from $9,541,251 to $5,167,791 (nearly 46 per cent), because of the decrease of more than 32 per cent in the output of copper from the Ray mines of the Nevada Consolidated Copper Co. and of 9 per cent in that from the Magma mine at Superior. Nearly all (1,475,49 tons) of the ore was of concentrating grade and yielded 148,155 tons of concentrates, chiefly copper concentrates. First-class ore smelted amounted to 61,145 tons, and siliceous gold ore treated by amalgamation amounted to 61 tons.

Bunker Hill district (*Copper Creek*).—In 1931 the Four Minerals Mining Co. was the only producer in the Bunker Hill district; the company shipped 1 car of oxidized copper-lead ore to the smelter at El Paso, Tex. The Fields Mining Corporation, the largest producer in the district in 1930, shipped no ore in 1931 but did 2,700 feet of development, chiefly in drifting and sinking a new shaft.

Casa Grande district.—Most of the mines in the Casa Grande district were idle in 1931; however, a test lot of rich silver ore from the Vekol mine was shipped to Hayden, a small quantity of gold ore from the property of the Casa Grande Valley Mining Co. was treated by amalgamation, and a small lot of gold concentrates from the Mammon property was marketed.

Cottonwood district.—Four lode mines in the Cottonwood district produced 162 tons of ore yielding $3,204 in gold, 121 ounces of silver, and 509 pounds of copper, valued in all at $3,285, or $20.28 in metals a ton. The entire output was first-class gold ore shipped to Hayden for smelting, chiefly from the Grand Prize mine, about 15 miles southwest of Winkelman, and partly from the Arizona Shearzone property.

Goldfields district.—Three lode mines in the Goldfields district produced 74 tons of ore yielding metals valued at $558, chiefly in gold. Gold bullion valued at about $252, resulting from experimental work on ores from the Mammoth group, was shipped to the Denver Mint by the Metallurgical Research & Mining Co., and a little gold bullion produced from the Apache Trail mine was also marketed. The Gold Bond mine was operated by a lessee who shipped 1 car of gold ore to the smelter at Superior.

Hackberry district.—The output of the Hackberry district consisted of test lots of gold ore from the Victory, Eagle, and Venado properties near Winkelman.

Mineral Creek district (*Ray, Kelvin*).—The Ray property of the Nevada Consolidated Copper Co., the only productive mine in the Mineral Creek district in 1931, was operated on a day-shift basis for 277 days through No. 2 shaft; shafts 1 and 3 were inactive the entire year. The property produced 1,304,668 tons of ore, of which 1,286,600 tons were treated at the Hayden mill and 18,068 tons, averaging 1.46 per cent copper, were shipped to the smelter at Hayden for converter lining. The output of concentrating ore decreased from 3,609,100 tons in 1929 to 2,327,100 tons in 1930 and to 1,286,600 tons in 1931, or more than 64 per cent. During 1931 the 12,000-ton concentrator at Hayden was operated 283 days at a greatly reduced rate. The mining cost, excluding depreciation and taxes but including all other overhead expenses, was 75.30 cents a ton compared with 67.99 cents in 1930. The milling cost was 39.76 cents a ton compared with 38.16 cents in 1930. The gross copper contained in the concentrates made at Hayden was 24,632,274 pounds compared with 36,454,720 pounds in 1930; the first-class smelting ore contained 528,589 pounds of copper, and the precipitates recovered from copper-bearing mine waters contained 32,660 pounds of copper. The net production for the year from all sources, after smelter losses were deducted, was estimated to be 24,438,038 pounds compared with 36,107,056 pounds in 1930 and 66,259,703 pounds in 1929. The property ranked ninth as a producer of copper in Arizona in 1931 and was also a fairly large producer of gold and silver. The mine is developed by vertical shafts and drifts; a total of 14,554 feet of work was done in 1931.

Mineral Hill district.—Nearly all the output in the Mineral Hill district was siliceous gold ore from the Aurora property 9 miles southeast of Superior; 50 tons of gold ore valued at $10 a ton and a small quantity of gold concentrate were marketed.

Old Hat district.—One placer and seven lode mines in the Old Hat district produced 105 tons of ore, $1,433 in gold, 166 ounces of silver, 3,388 pounds of copper, and 167 pounds of lead, valued in all at $1,795, a decrease from $8,186 from six lode mines in 1930. The output in 1931 consisted of siliceous gold ore from the Daily, Buster & Larson, and Irene properties, a test lot of lead ore and a little gold ore from the Winchester (Castro) property, and gold ore and copper ore from prospects in the Santa Catalina Mountains near Oracle. The placer output amounted to $97 in gold and 3 ounces of silver.

Owl Head district.—The output of the Owl Head district consisted of 35 tons of siliceous gold ore from the Golden Eagle mine of the Tellurium Trio Mining Co. 12 miles northeast of Marana.

Pioneer district (Superior).—Six lode mines in the Pioneer district produced 230,992 tons of ore yielding $154,359 in gold, 693,777 ounces of silver, 28,103,240 pounds of copper, and 18,741 pounds of lead, valued in all at $2,913,643, or $12.61 in metals a ton. The output consisted of 188,892 tons of ore of milling grade, which was reduced to 78,464 tons of concentrates, and 42,100 tons of first-class ore (chiefly copper ore). In 1930 the district produced 253,109 tons of ore yielding metals valued at $4,705,413. As in the past, the largest producer in the district was the Magma Copper Co., which operated its mine, mill, and smelter at Superior about nine months. As the result of curtailed operations in 1931 the quantity of ore produced at the Magma mine in 1931 decreased 8 per cent from that in 1930, the output of copper nearly 9 per cent, gold nearly 12 per cent, and silver more than 15 per cent. The mine ranked second as a producer of silver in Arizona in 1931, sixth as a producer of gold, and seventh as a producer of copper.

According to the annual printed report of the company the Magma mine produced 231,862 tons of ore of all classes containing an average of 6.65 per cent copper and 2.98 ounces of silver and 0.033 ounce of gold to the ton. From above the 650 level lessees mined 121 tons of oxidized ore averaging 15.70 per cent copper and 28.77 ounces of silver and 0.11 ounce of gold to the ton. Most of the ore mined by the company was concentrated in the 600-ton combined gravity and flotation plant, which was closed from June 16 to September 16. The mill ore averaged 6.16 per cent copper and the tailings 0.22 per cent, and extraction was 97.93 per cent of the copper. The concentrates, several thousand tons of first-class smelting ore, and 2,320 tons of custom concentrates and crude ore were treated in the company's 450-ton smelter at Superior, which was closed from June 22 to October 1. The total net smelter production, after all losses including refining were deducted, was 28,839,617 pounds of copper, 771,316 ounces of silver, and 9,243.59 ounces of gold, of which 28,760,628 pounds of copper, 701,576 ounces of silver, and 7,512.75 ounces of gold were produced from smelting ore and concentrates from the Magma mine. The average net cost of producing copper, after the value of gold and silver was deducted, was 8.39 cents a pound, compared with 8.97 cents in 1930. This cost does not include any allowance for depletion or Federal taxes but includes State and county taxes (about 1.07 cents a pound), depreciation, and all other fixed and general expenses. The average net selling price received for copper, in excess of all commissions and delivery charges, was 8.9334 cents a pound. In 1931 development consisted of 6,311 feet of drifting, 2,710 feet of raising, 1,051 feet of sinking, and 2,037 feet of crosscutting, a total of 12,109 feet for the year. The total to date is 190,069 feet. Dividends paid to stockholders by the Magma Copper Co., from the time of its organization to January 15, 1932, amounted to $10,428,313, of which four dividends totaling $714,271 were paid in 1931; a dividend of $51,019 was declared payable January 15, 1932. Income from the sales of copper amounted to $2,689,331, and gold and silver sales amounted to $449,815; after various expenses were deducted the net gain for the year was $206,225, and the balance December 31, 1931, was $955,152.

The property of the Belmont Copper Mining Co. was operated by a lessee who shipped several cars of first-class copper ore to the smelter at Superior, Ariz., and 1 car of first-class lead ore to El Paso, Tex.

The remainder of the district output consisted of 1 car of copper ore rich in silver from the Silver King mine and small lots of lead ore, silver ore, and copper ore from prospects near Superior.

Ripsey district.—More than 400 tons of first-class silver ore were shipped from the property of the Florence Lead & Silver Mines (Inc.) before the mine was closed in May as a result of the low price of silver. The ore contained 54 ounces of silver to the ton and a little gold and copper.

Saddle Mountain district.—The output of the Saddle Mountain district was all first-class smelting ore, chiefly small lots of siliceous gold ore from the Hoosier, Mary Piper, and Rieder properties on Ash Creek.

Summit district.—The American property 12 miles west of Miami was the only producer in the Summit district in 1931; 1 car of oxidized copper ore containing nearly 25 ounces of silver to the ton was shipped by lessees.

SANTA CRUZ COUNTY

Thirteen lode mines in Santa Cruz County produced 2,316 tons of ore—27,546 tons less than was reported from 36 lode mines in 1930. In addition to the production from lode mines two placer properties in the Patagonia district produced bullion valued at $690. The total value of the metal output from mines in Santa Cruz County decreased from $405,161 in 1930 to $53,797 in 1931, chiefly as a result of the closing on April 15, 1930, of the Montana mill of the Eagle-Picher Lead Co. at Ruby. The decreased output of copper ore from the Santo Nino mine also contributed to the large decrease in total production. The entire output of the county was first-class smelting ore, chiefly lead ore and siliceous silver ore.

Harshaw district.—Three lode mines in the Harshaw district produced 1,758 tons of ore yielding $1,641 in gold, 124,626 ounces of silver, 23,661 pounds of copper, and 122,308 pounds of lead, valued in all at $44,460, or $25.29 in metals a ton. The entire output was first-class smelting ore from the World's Fair, Hardshell, and Flux mines. The World's Fair mine, operated during the first part of the year by the Trench Mining Co. and for the remainder of the year by lessees, was the largest producer in the county. The output consisted of about 1,000 tons of siliceous silver ore and about 400 tons of sulphide lead ore. Lessees also operated the Hardshell and Flux mines; several cars of oxidized lead ore from each property were shipped to the smelter at El Paso, Tex.

Oro Blanco district.—No production has been reported from mines in the Oro Blanco district since the closing in April, 1930, of the Montana mill of the Eagle-Picher Lead Co. In 1930 the Montana property was the largest producer of zinc and lead in Arizona.

Patagonia (Washington, Duquesne) district.—Two placers and five lode mines in the Patagonia district produced 487 tons of ore, $1,246 in gold, 4,369 ounces of silver, 14,005 pounds of copper, and 117,949 pounds of lead, valued in all at $8,152. The ore had an average value of $15.32 in metals a ton. The placer output, valued at $690, came from properties in Porcupine and Providence Canyons. The total output decreased considerably from that in 1930, when seven lode mines produced 3,157 tons of ore yielding metals valued at $58,223. The decrease resulted from the decline in shipments of copper ore from the Santo Nino mine, which was operated in 1931 by a lessee who shipped 82 tons of sulphide copper ore of smelting grade to Douglas, Ariz. The lessee also hauled from the Santo Nino about 200 tons of ore containing molybdenite to Nogales for treatment in a 25-ton flotation mill; the resulting molybdenum concentrates (16 tons) were shipped to El Paso, Tex. The remainder of the district output was chiefly oxidized lead ore of smelting grade from the Mowry and Pocahontas mines.

Tyndall district (*Alto*).—Five lode mines in the Tyndall district produced 71 tons of first-class smelting ore yielding $75 in gold, 1,085 ounces of silver, 3,101 pounds of copper, and 13,861 pounds of lead, valued in all at $1,185, or $16.69 in metals a ton. The output was copper-lead ore from the Alto property and small lots of lead ore from the Connecticut, Oak, and Wandering Jew properties and from a prospect near Alto.

YAVAPAI COUNTY

In Yavapai County the production of each of the metals decreased notably. Ninety-two mines were producing—six more than in 1930. The output of ore, old tailings, etc., decreased from 1,395,527 to 431,174 tons, gold from $1,214,133 to $452,072, silver from 1,930,906 to 565,737 fine ounces, copper from 117,690,154 to 44,575,966 pounds, and lead from 236,620 to 16,579 pounds; the output of zinc in 1930 was 9,930 pounds, but no zinc was marketed in 1931. The total value of the metals decreased from $17,269,559 to $4,673,162 (nearly 73 per cent), an actual decrease greater than that recorded in any other county in the State. The unusually large decrease in total value, which caused the county to drop from third to fourth place after Gila, Cochise, and Pinal Counties, resulted chiefly from the closing of the United Verde property in May and the suspension of operations at the United Verde Extension property from July 1 to November 1.

Of the total (383,814 tons) first-class ore shipped to smelters 379,848 tons were sulphide copper ore; the total smelting ore yielded metals valued at $4,245,333 (an average of $11.06 to the ton). Concentrates amounting to 21,170 tons, derived from 46,112 tons of milling ore and from a little ore first treated by amalgamation, yielded metals valued at $393,643. Gold and silver bullion valued at $6,918 was recovered from 1,198 tons of ore treated by amalgamation and 17 tons treated by cyanidation. Miscellaneous material, including old tailings smelted and mill clean-up material smelted, yielded gold, silver, and copper valued at $1,066. Copper recovered from precipitates was valued at $14,119. The placer output was $12,064 in gold and 65 ounces of silver compared with $8,384 in gold and 49 ounces of silver in 1930.

Ash Creek district.—One car of siliceous gold ore from the Gold Coin property 11 miles east of Dewey was shipped to Hayden for smelting.

Big Bug district.—Seven placers and 12 lode mines in the Big Bug district produced 1,122 tons of ore, $12,933 in gold, 3,185 ounces of silver, 10,478 pounds of copper, and 9,220 pounds of lead, valued in all at $15,151, a decided decrease from a district output of $85,157 in 1930. The ore was valued at $9.57 in metals a ton. The output consisted of 165 tons of ore amalgamated, 17 tons of ore cyanided, 500 tons of ore concentrated, and 440 tons of ore smelted. Several hundred tons of gold ore from the dumps and old stopes of the Union-Jessie-Dividend group were treated in a flotation mill by the Southwest Mines Development Co.; the concentrates, exceptionally rich in gold, were shipped to Hayden and Superior for smelting. Lessees operating the Hackberry (Boggs) group and the Gopher mine shipped several cars of low-grade gold ore from each property. Siliceous gold ore was also shipped from the Hamilton-Poland, Burlington, and Gladstone-McCabe properties and from a dump near Iron Springs. A small part of the gold ore from the Hamilton-Poland group was treated by cyanidation, and the gold ore from the Mary Copper mine was treated by amalgamation. Oxidized copper ore of smelting grade was shipped from the Lottie, Upshot (Lawson), and Deer's Rest properties, and lead ore from the Arizona National property was treated by a combination of table concentration and flotation. The placer output of the Big Bug district was valued at $4,409 compared with $3,242 in 1930; it came from several properties on Big Bug Creek, chiefly the Windy, Pleich, and Panama No. 1 claims.

Black Canyon district.—One placer and four lode mines in the Black Canyon district produced 1,581 tons of ore, $8,693 in gold, 4,369 ounces of silver, 1,314 pounds of copper, and 2,397 pounds of lead, valued in all at $10,168. The ore had an average value of $6.38 in metals a ton. The output consisted of 50 tons of ore treated by amalgamation, 1,345 tons of ore concentrated, and 186 tons of first-class smelting ore. The Golden Belt Mines (Inc.), operating the Golden Belt property near Cordes, treated 1,345 tons of gold ore in the rebuilt 50-ton flotation plant and shipped 134 tons of rich gold concentrates and 107 tons of first-class smelting ore. The remainder of the district output consisted of gold ore from the Phantom and old Bland groups near Bumble Bee and siliceous gold and silver ore from the Gold Crown (Silver Chord) property near Cleator. Placer gold valued at $80 was produced from a claim near Bumble Bee.

Black Rock district.—The output of the Black Rock district was chiefly siliceous gold ore from the Amazon (Bob Groom) property, operated by the Milevore Copper Co. (Ltd.). About 800 tons of gold ore from the Amazon property were treated in a 40-ton mill equipped with amalgamation plates and flotation cells. The Oro Grande Consolidated Mines Co. did considerable work at its property near Wickenburg and treated a test lot of gold ore by amalgamation.

Bullard district.—A small quantity of siliceous gold ore from the Gold Leaf property 7 miles northeast of Aguila was shipped to the smelter at Hayden.

Castle Creek district.—The output of the Castle Creek district was 46 tons of ore yielding metals valued at $745. Nearly all the output was siliceous gold ore from the Rattlesnake and Stockdale claims near Hot Springs treated by concentration.

Cherry Creek district.—One car of low-grade siliceous gold ore from the Golden Eagle mine, 4 miles southwest of Cherry, was shipped to Hayden for smelting.

Copper Basin district.—Four placers in the Copper Basin district produced $1,021 in gold and 8 ounces of silver, valued together at $1,023. The chief producers were the Aztec, Old Camp, and Richland claims.

Eureka district.—Five lode mines in the Eureka district produced 218 tons of ore yielding $5,348 in gold, 704 ounces of silver, 1,184 pounds of copper, and 3,642 pounds of lead, valued in all at $5,795, a decrease of $29,875 from the district output in 1930. The Bagdad Copper Corporation 28 miles northwest of Hillside, the chief producer in 1930, was idle in 1931. Most of the output in 1931 was siliceous gold ore from the Crosby mine 18 miles west of Hillside. Lessees operating the property shipped nearly 100 tons of crude smelting ore averaging more than 1.7 ounces of gold to the ton and treated about 25 tons of gold ore by amalgamation and gravity concentration. Other producers of gold ore of smelting grade were the Mammoth, Dunlap, and Sultan mines. One car of first-class lead ore containing nearly 1 ounce of gold to the ton was shipped from the Cowboy property to El Paso, Tex. The Bagdad Copper Corporation has developed a large reserve of low-grade copper ore in monzonite. The property is equipped with a 200-ton flotation plant, but operations were suspended in September, 1930, as a result of the low price of copper. The company planned to erect a large concentrator and a hydrometallurgical plant to treat the concentrates, but construction of the units has been indefinitely postponed.

Granite Creek district.—Placer bullion valued at $390 was marketed from various claims on Granite Creek.

Hassayampa district.—Two placers and eight lode mines in the Hassayampa district produced 2,550 tons of ore and old tailings, $22,837 in gold, 14,266 ounces of silver, and 71,762 pounds of copper, valued in all at $33,505. The ore and old tailings were valued at $12.89 in metals a ton. The placer output—$629 in gold and 5 ounces of silver—came from properties on Groom and Hassayampa Creeks. In 1930, 21,835 pounds of lead and 9,930 pounds of zinc were produced, but no lead or zinc was produced in 1931. The lode mines produced 48 tons of ore treated by amalgamation, 1,970 tons of ore and 32 tons of old tailings directly smelted, and 500 tons of concentrating ore. More than half (1,231 tons) of the crude ore of smelting grade was oxidized copper ore from the Senator group operated by lessees; the remainder was siliceous gold ore chiefly from the Sterling and Midnight Test properties. The Midnight Test property was operated the entire year by the National Exploration Corporation, and several hundred tons of gold ore were treated by a combination of gravity and flotation concentration; rich gold concentrates and several cars of first-class siliceous gold ore were shipped to Hayden for smelting. Several cars of siliceous gold ore were also shipped from the Ore Flame and American Eagle claims (Sterling group), several cars of low-grade gold ore and old tailings were shipped from dumps near Prescott, and a little gold ore from the Empire and Hidden Treasure mines was treated by amalgamation.

Martinez district.—Nearly all the output of the Martinez district was low-grade siliceous gold ore from the Congress dumps; about 600 tons of the material were shipped to smelters at Superior and Hayden. The Blue Bird mine near Congress was operated a short time, and 2 cars of gold ore were shipped to Hayden for smelting. A little placer gold from the Gold Spot claim on Martinez Creek was sold to a local merchant.

Oak Creek district.—A little placer gold was marketed from a property on Oak Creek, near Wagoner.

Ochocomo district.—One car of siliceous gold ore from the property of the Vindicator Gold Mining Syndicate 30 miles northwest of Congress Junction was shipped to the smelter at Superior.

Pine Grove district.—The Calincoln Mines (Inc.) erected a new power plant and installed a new compressor, hoist, and other equipment at the Lincoln mine near Crown King; the company shipped several cars of siliceous gold ore to Hayden for smelting. Gold valued at about $860 was marketed from cleaning up an old mill near Crown King.

Silver Mountain district.—A test lot of gold ore from the Gold Coin property was treated by amalgamation.

Tip Top district.—Placer gold valued at about $210 was marketed from several claims on Cow Creek near Morristown.

Verde district (Jerome).—The continued decline in the market price of silver and copper and the unusually large decrease in mine output resulted in a decrease of nearly 73 per cent in the total value of the metal production of the Verde district in 1931 as compared with 1930. In 1930 and 1931 the Verde district ranked third among the districts of Arizona in value of output, following the Globe and Warren districts. The unusually large decrease in 1931 resulted chiefly from the closing of the United Verde mine and smelter in May, 1931, and from the suspension of operations at the United Verde Extension property for four months. The Verde Central mine was idle in 1931; both the mine and the 400-ton flotation mill were sold to the United Verde Copper Co. The output of the Verde district is not published in this review as the United Verde Copper Co., the largest producer at Jerome, publishes no annual report and objects to having its production made public. In general, however, the output consisted of copper ore of smelting grade from the United Verde and United Verde Extension mines, copper ore of concentrating grade from the United Verde Extension mine, and a small lot of siliceous gold ore from a prospect near Clarkdale. The entire copper output of the district was reduced to blister copper at smelters at Clarkdale and Clemenceau.

The closing in May of the mine and smelter of the United Verde Copper Co. resulted in a decrease of nearly 72 per cent in the company's output of copper compared with 1930. The United Verde mine has dropped from first place in production of copper in 1929 to tenth in 1931. The entire output in 1931 was ore of smelting grade treated at the reverberatory plant at Clarkdale; the 1,800-ton flotation concentrator and the blast-furnace plant were idle the entire year. A rock slide in the open pit in April caused suspension of open-pit mining, and all ore produced after that time came from underground operations. A large crew of men was retained in the open pit the remainder of the year removing the rock caused by the slide, cutting a new pit approach, and reducing the angle of slope in the pit by widening the benches. Underground development was continued throughout the year, chiefly in completing the new No. 7 shaft from the 300 (surface) to the 3,500 level. A waste dump of about 600,000 tons was removed to make space for the surface equipment of the No. 7 shaft; and the concreting of the new shaft was practically completed at the end of the year, although the headframe and hoisting equipment had not been erected. The history, development, and operations at both the open-pit and underground sections of the mine have been described in articles referred to in earlier reports of this series. Attention is again called to the comprehensive review[5] of every phase of the United Verde enterprise, including details on history, mining, milling, smelting, and research, published in 1930. The 1,800-ton flotation mill at Clarkdale has been idle since July, 1930; a new section of about 500 tons capacity was added in 1931. The new unit is entirely independent of the other units of the mill and is designed to recover both copper concentrates and zinc concentrates from United Verde copper-zinc ore. It had not been placed in operation when the property was closed.

The United Verde Extension Mining Co. operated its mine at Jerome for eight months in 1931; mining was suspended on July 1 and resumed on November 1. According to the company's printed annual report for the year 1931 a total of 183,151 tons of sulphide copper ore was mined; it was treated in the company mill and smelter. The 200-ton flotation mill at Clemenceau treated 43,720 tons of ore averaging 0.049 ounce of gold and 1.17 ounces of silver to the ton and 4.50 per cent copper; the direct smelting ore (146,330 tons) averaged 0.036 ounce of gold and 1.37 ounces of silver to the ton and 7.82 per cent copper. A total of 24,590,712 pounds of copper, as well as some gold and silver, was produced from the crude smelting ore and concentrates, a decrease of 14,292,697 pounds (nearly 37 per cent) from 1930. The property ranked fifth in production of silver in Arizona in 1931, seventh in gold, and eighth in copper. In former years the company's 800-ton smelter at Clemenceau received large shipments of custom material, chiefly copper concentrates from the Verde Central and Sheldon mills, but only one small shipment of siliceous gold ore containing a little silver and copper was received in 1931. Both the flotation plant and smelter were operated eight months in 1931; No. 1 reverberatory was operated 102 days and No. 2 reverberatory 202 days, and the copper blast furnace was idle. No important changes were made at the milling and smelting plants in 1931. The mine at Jerome is opened by a 2½-mile main haulage tunnel (10 by 10 feet) which connects with two 3-compartment vertical shafts on the 1,300-foot level. Levels are opened from the two shafts at 100 or 150 foot intervals from the 400 to the 1,900 foot level. In 1931 the company did 5,039 feet of development consisting of 3,964 feet in drifts and 1,075 feet in raises. The cost of producing 1 pound of copper from the United Verde Extension mine was as follows: Mining, 2.69 cents;

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[5] Mining Congress Journal, The United Verde Copper Co.: April, 1930, p. 300.

concentrating and smelting, 2.31 cents; freight on ore, 0.07 cent; freight on bullion, refining, and selling, 1.77 cents; other expenses, 0.30 cent; total, 7.14 cents. This cost does not include depreciation or taxes. Gross revenue from the sale of bullion was $2,342,830. After charges amounting to $1,992,801 were deducted for mine and smelter operations, freight, refining, selling, and other expenses (including depreciation and State and county taxes) the earnings from operations were $350,029, and after $149,388 was added from other revenue and $881,577 deducted for Federal taxes and losses sustained there was a net loss to surplus of $382,160, exclusive of charges for depletion. Dividends paid to stockholders in 1931 amounted to $1.50 a share—$1,575,000 in all—making a total dividend disbursement of $39.35 a share—$41,317,500—paid since organization of the company in 1916.

The mine and mill of the Verde Central Mines (Inc.), which have been idle since operations were suspended on October 31, 1930, were sold in July, 1931, to the United Verde Copper Co.

Walker (*Lynx Creek*) *district.*—Four placers and two lode mines in the Walker district produced 36 tons of ore, $1,882 in gold, 266 ounces of silver, 1,234 pounds of copper, and 615 pounds of lead, valued in all at $2,094, a marked decrease from a district output of $170,645 in 1930. The placer output, valued at $1,034, came from several claims on Lynx Creek. The large decrease in total value of output in 1931 resulted from the closing of the Sheldon mill in September, 1930. Excluding 1928, the Sheldon mine has been a large producer of gold, silver, and copper since 1923. The Sheldon Mining Co. did 840 feet of drifting in 1931 and shipped 1 car of siliceous gold ore to a smelter. A small test lot of first-class lead ore from the Little Rock mine was shipped to El Paso, Tex.

Walnut Grove district (*Wagoner*).—Two placers and two lode mines in the Walnut Grove district produced metals valued at $639. The placer output, valued at $255, came from prospects near Wagoner and Placeritas. A little gold ore from the Golden Eagle property near Wagoner was treated by amalgamation, and a little first-class gold and silver ore from a prospect near Kirkland was shipped to a smelter.

Weaver district.—Eight placers and five lode mines in the Weaver district produced 198 tons of ore, $6,860 in gold, 130 ounces of silver, and 669 pounds of copper, valued in all at $6,958, compared with a district output of $4,218 in 1930. The placer output, valued at $3,866, was more than twice that in 1930. The Hawkeye, Yavapai, Red Bank, and Rich Hill placers were productive; the remainder of the placer output came from several claims near Octave. The Yavapai Gold Mining Co. erected a small washing and sluicing plant to treat gravel mined by a steam shovel from its placer ground near Octave. Operations were limited because of shortage of water; late in the year a 9-mile pipe line was under construction to increase the water supply. The production from lode mines was chiefly siliceous gold ore from the Beehive property treated by amalgamation and first-class gold ore of smelting grade from the Dora (Koerber) and Pan American (Rincon) properties.

White Picacho district.—A little siliceous gold ore from the Producer & Golden Rule group, 13 miles northeast of Hot Springs Junction, was treated by amalgamation.

YUMA COUNTY

The total value of the production of gold, silver, copper, and lead in Yuma County was $13,047 in 1931, a decided decrease from $138,438 in 1930. The output of each metal decreased, especially that of copper. Twelve lode mines produced 481 tons of ore in 1931, compared with 16,633 tons of ore and old tailings from 23 lode mines in 1930. The value of the placer output increased from $2,292 to $4,322. The closing of the Clara-Swansea property in July, 1930, resulted in a large decrease in the output of copper.

Castle Dome district.—The output of the Castle Dome district comprised 41 tons of crude smelting ore from the New Cleveland property, containing 24 ounces of silver to the ton and nearly 72 per cent lead, and a small quantity of rich gold ore from the Lookout property, 30 miles northwest of Dome.

Cienega district.—The output of the Cienega district was chiefly gold ore from the property of the Lion Hill Gold Mining Co., 8 miles north of Parker. The company treated 110 tons of ore in a 25-ton amalgamation mill and marketed gold bullion valued at $2,014. One car of oxidized copper ore was shipped from the Black Hills property.

Dome (*Gila City*) *district.*—Bullion valued at about $850, recovered from placer claims near Dome, was sold to a local merchant.

Ellsworth district.—One placer and five lode mines in the Ellsworth district produced 290 tons of ore, $2,697 in gold, 135 ounces of silver, and 2,354 pounds of copper, valued in all at $2,950. The placer output was valued at $55. The output from lode mines was chiefly low-grade gold ore from the Rio del Monte mine, 5 miles southeast of Salome, and first-class gold ore from the True Blue group, 4 miles northeast of Vicksburg.

Fortuna district.—Old tailings from the Fortuna dump 22 miles southeast of Yuma were treated by placer methods and the gold recovered, valued at $375, was sent to the San Francisco Mint.

Kofa district.—The output of the Kofa district consisted of small lots of rich gold ore from the old Ironwood mine 50 miles east of Quartzsite. The Sheep Tanks (Resolution) mine, a fairly large producer of gold in 1929, was being developed in 1931 by the Anozira Mining & Milling Co.

Laguna district.—Several placer operators in the Laguna district, mostly on the Colorado River near Yuma, produced bullion valued at $1,533, an increase from $839 in 1930.

Never Sweat district.—The Addie group 32 miles northeast of Roll produced a small lot of smelting ore averaging $30 a ton in silver and lead.

Plomosa district.—Three placers in the Plomosa district near Quartzsite produced bullion valued at $1,425, most of which was recovered from the Happy Day claim by drift mining. No production was reported from lode mines in 1931.

ORE-CONCENTRATION STATISTICS

METALLURGICAL RESULTS AND FLOTATION REAGENTS [1]

By T. H. Miller and R. L. Kidd

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INTRODUCTION

In 1931 nearly 83 per cent of the nonferrous ore mined in the United States was treated by concentration at plants using flotation equipment. The rapid expansion in the use of flotation concentration in recent years has necessitated the publication of a yearly report presenting the salient features in the development of the flotation process. It is the purpose of this report to present data concerning the metallurgical results obtained and the flotation reagents consumed and other milling-plant information in such a manner as to have value to the manufacturers of flotation reagents and equipment and to individual milling-plant operators. The 1930 report included an annotated bibliography of flotation literature published during the year, but funds were not available to include the bibliography for 1931.

ACKNOWLEDGMENTS

The data summarized in this report were obtained from about 250 concentration plants in the United States. Individual mill reports were collected by the field offices of the division of mineral statistics and were edited and tabulated in the Salt Lake City (Utah) office. The authors realize that the value of the report depends largely on the completeness of the survey, and thanks are due to the large number of individual plant operators who cooperated.

TOTAL ORES CONCENTRATED

The sharp curtailment in the output of nonferrous ores in 1931 resulted in a decrease of 30 per cent in the quantity of ore concentrated. The output of direct smelting ore and ore to miscellaneous plants was similarly reduced, but the output of ores sent to amalgamation or cyanidation mills was increased. The total production of nonferrous ore was 54,764,842 tons in 1931 compared with about 76,725,000 tons in 1930 and about 106,179,000 tons in 1929. More than 83 per cent of the nonferrous ore produced was treated by concentration, 3.83 per cent was shipped direct to smelters, 6.26 per cent was treated at gold and silver mills, and the remaining 6.66 per cent was treated at miscellaneous plants including copper leaching plants and magnetic separation plants. Of the total ore concentrated (45,591,896 tons), 60.98 per cent was treated by straight flotation concentration, 38.61 per cent by combined gravity and flotation concentration, and 0.41 per cent was treated at plants using straight gravity concentration.

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[1] Work on manuscript completed November, 1932.

Table 1 gives the total nonferrous ore produced in 1931, by classes of ore and methods of treatment. The large quantity of copper ore treated by combined gravity and flotation concentration was mostly native copper ore from Michigan mines. Most of the lead ore similarly treated came from mines in southeastern Missouri and most of the lead-zinc ore and zinc ore from mines in the tri-State region.

TABLE 1.—*Total nonferrous ore produced in the United States in 1931, by classes of ore and methods of treatment, in dry tons*

Method of treatment	Copper ore	Copper-lead ore	Lead ore	Lead-zinc ore	Zinc ore	Gold and silver ore	Total ore
Straight flotation concentration	25, 075, 683	195, 392	236, 398	1, 543, 165	356, 861	396, 684	27, 804, 183
Combined gravity and flotation concentration	5, 053, 372	----------	5, 652, 446	4, 120, 029	2, 774, 762	570	17, 601, 179
Straight gravity concentration	850	----------	9, 699	102, 500	69, 000	4, 485	186, 534
Total ore concentrated	30, 129, 905	195, 392	5, 898, 543	5, 765, 694	3, 200, 623	401, 739	45, 591, 896
Direct smelting	1, 531, 840	7, 942	144, 626	18, 051	88, 646	303, 377	2, 094, 482
Amalgamation or cyanidation	----------	----------	----------	----------	----------	3, 428, 960	3, 428, 960
Miscellaneous methods	2, 785, 735	----------	----------	240, 080	623, 689	----------	3, 649, 504
Total, all methods	34, 447, 480	203, 334	6, 043, 169	6, 023, 825	3, 912, 958	4, 134, 076	54, 764, 842

TOTAL CONSUMPTION OF REAGENTS

Table 2 gives the total consumption of flotation reagents in the treatment of 35,955,669 tons of ore at 160 plants in 1931. The per-ton consumption of reagents in 1930 and 1931 is compared.

Frothing reagents.—Pine oils and cresylic acid continued to be the chief frothing reagents. In 1931, as in 1930, pine oils accounted for about 60 per cent of the total frothers used. There was a sharp decrease in the use of orthotoluidine due to the adoption of pine oil at a plant treating lead-zinc ore.

Collecting reagents.—Coal-tar creosotes continued to be the chief collecting reagent in the distillation products group, with blast-furnace oils next. There was a marked reduction in the consumption of wood-tar creosotes. Xanthates continued to be the chief synthetic collectors, and the use of amyl xanthates expanded. There were sharp decreases in the consumption of dicresol-dithiophosphoric acid and thiocarbanilide. No sodium dibutyl-dithiophosphate, alpha naphthalamine, or oleic acid was reported for 1931. One plant treating oxidized lead ore reported the use of thioamino-phosphate.

Acids.—As in the past nearly all the acid reported was used by plants treating copper-iron ores. In 1931, four plants reported the experimental use of sulphuric acid.

Other reagents.—The per-ton consumption of sodium sulphide increased from 0.154 pound in 1930 to 0.723 pound in 1931 due to suspension of the use of sodium sulphide at four plants treating copper ore, which resulted in a higher per-ton consumption at other plants. The use of starch in the treatment of gold and silver ores was reported in 1931 for the first time.

TABLE 2.—*Consumption of reagents in the treatment of all ores in 1931*

[160 plants treating 35,955,669 tons of ore]

Reagent	Plants using	Ore treated, tons	Consumption of reagents, pounds		
			Total, 1931	Per ton	
				1931	1930
I. Frothers:					
Pine oils	132	26, 633, 104	3, 281, 543	0. 123	0. 121
Cresylic acid	69	13, 463, 643	2, 225, 282	. 165	. 156
Orthotoluidine	2	114, 878	943	. 008	. 181
Total frothers	159	35, 955, 417	5, 507, 768	. 153	. 152
II. Collectors:					
Distillation products—					
Coal-tar creosotes	46	2, 638, 204	490, 862	. 186	. 132
Wood-tar creosotes	8	1, 334, 456	68, 880	. 052	. 057
Pine-tar oils	2	937, 600	5, 200	. 006	--------
Petroleum products	3	153, 059	15, 799	. 103	. 089
Blast-furnace oils	2	2, 117, 951	169, 102	. 080	. 074
Water-gas tars	2	13, 291	2, 825	. 213	. 250
Total distillation products	56	5, 967, 825	752, 668	. 126	. 106
Synthetic products—					
Ethyl xanthates	123	21, 818, 994	2, 411, 203	. 111	. 108
Butyl xanthates	3	4, 091, 282	212, 926	. 052	. 025
Amyl xanthates	34	10, 573, 890	300, 904	. 028	. 022
Xanthate derivatives	8	5, 718, 156	64, 764	. 011	. 001
Dicresol-dithiophosphoric acid	52	2, 721, 911	298, 316	. 110	. 055
Sodium dicresol-dithiophosphate	23	3, 071, 868	106, 172	. 035	. 039
Sodium diethyl-dithiophosphate	1	8, 147, 764	105, 776	. 013	. 013
Thioamino-phosphate	1	252	40	. 159	--------
Thiocarbanilide	8	705, 204	42, 975	. 061	. 030
Total synthetic products	153	35, 474, 637	3, 543, 076	. 100	. 107
Total collectors	160	35, 955, 669	4, 295, 744	. 119	. 130
III. Acids and alkalies:					
Acids—sulphuric acid	7	522, 107	11, 142, 955	21. 342	24. 933
Alkalies—					
Sodium carbonate	32	1, 498, 036	877, 852	. 586	. 420
Sodium bicarbonate	1	58, 636	14, 659	. 250	--------
Sodium hydroxide	1	147, 505	8, 400	. 057	. 256
Lime	55	29, 256, 502	112, 897, 662	3. 859	3. 645
Cement	1	266, 300	1, 945, 518	7. 306	8. 246
Total alkalies	80	30, 045, 158	115, 744, 091	3. 852	3. 560
IV. Other inorganic reagents:					
Sulphidizing—sodium sulphide	15	888, 986	642, 815	. 723	. 154
Activating—copper sulphate	83	5, 611, 071	3, 324, 908	. 593	. 697
Depressing—					
Cyanides	26	11, 680, 122	589, 091	. 050	. 056
Sodium sulphite	4	318, 045	368, 171	1. 158	. 464
Sodium silicate	8	303, 830	261, 782	. 862	. 539
Zinc sulphate	23	3, 509, 850	1, 018, 803	. 290	. 423
Sodium bichromate	1	41, 079	14, 379	. 350	. 177
Sodium sulphate	1	43, 342	6, 049	. 140	--------
Total depressing	43	13, 591, 367	2, 258, 275	. 166	. 239
Miscellaneous—					
Sodium chloride	1	80, 968	100, 645	1. 243	. 102
Sodium bisulphite	1	9, 911	14, 170	1. 430	--------
Sodium aluminate	1	21, 700	870	. 040	--------
Starch	2	143, 221	36, 068	. 252	--------
Total reagents	160	35, 955, 669	143, 068, 309	3. 979	4. 036

TABLE 3.—*Comparison of consumption of reagents, 1927–1931*

	1927	1928	1929	1930	1931
Ore treated thousands of tons	50,073	59,064	65,405	47,259	35,956
Reagent consumption:					
Frothers thousands of pounds	6,583	9,052	9,283	7,106	5,508
Collectors—					
Distillation do	3,509	3,021	2,345	1,107	753
Synthetic do	5,767	4,863	5,925	5,018	3,543
Acids do	9,749	12,442	12,099	12,060	11,143
Alkalies do	176,766	215,858	234,598	154,424	115,744
Sulphidizing do	5,091	2,399	2,589	1,226	643
Activating do	5,909	6,898	6,723	5,390	3,325
Depressing do	7,140	9,500	6,050	4,393	2,409
Total reagents do	220,514	264,033	279,612	190,724	143,068
Reagent consumption:					
Frothers pounds per ton of ore treated	(1)	0.155	0.144	0.152	0.153
Collectors—					
Distillation do		.128	.124	.106	.126
Synthetic do		.082	.091	.107	.100
Acids do		27.716	22.030	24.933	21.342
Alkalies do		3.873	3.735	3.560	3.852
Sulphidizing do		.329	.713	.154	.723
Activating do		.721	.627	.697	.593
Depressing do		.287	.213	.239	.174
Total reagents do	(1)	4.470	4.275	4.036	3.979

[1] Figures not available.

COPPER ORES

Table 1 shows that mines in the United States produced 34,447,480 tons of copper ore of all classes in 1931 compared with about 47,676,000 tons in 1930. Of the total ore produced, 2,785,735 tons (8.09 per cent) were treated at miscellaneous plants including leaching plants and magnetic separation plants, 1,531,840 tons (4.45 per cent) were treated by direct smelting, and the remaining 30,129,905 tons (87.46 per cent) were treated at concentration plants. Of the total ore concentrated, 25,075,683 tons (83.23 per cent) were treated by straight flotation and 5,053,372 tons (16.77 per cent) by combined gravity and flotation concentration. An insignificant remainder (850 tons) was treated at straight gravity concentration plants.

SULPHIDE COPPER ORES

Table 4 gives the consumption of reagents in the treatment of sulphide copper ores. A total of 25,978,660 tons of ore treated was reported by 20 plants in 1931 compared with 34,050,473 tons of ore treated by 39 plants in 1930.

Flotation reagents.—There were no marked changes in the per-ton consumption of reagents, but the number of flotation reagents used in copper circuits was materially reduced in 1931; no orthotoluidine, wood-tar creosotes, petroleum products, sodium dibutyl-dithiophosphate, or thiocarbanilide were reported. Distillation collectors were used in the treatment of only 8 per cent of the total ore as compared with 14 per cent in 1930 and 21 per cent in 1929. Xanthates continued to be the chief synthetic collectors. There was a marked reduction in the quantity of ore treated by sodium sulphide, resulting in increased per-ton consumption of this reagent.

TABLE 4.—*Consumption of reagents in the treatment of sulphide copper ores in 1931*

[20 plants treating 25,978,660 tons of ore]

Reagent	Plants using	Ore treated, tons	Consumption of reagents, pounds		
			Total, 1931	Per ton	
				1931	1930
I. Frothers:					
Pine oils	18	17, 787, 176	2, 548, 088	0. 143	0. 136
Cresylic acid	4	8, 441, 162	1, 452, 283	. 172	. 190
Total frothers	20	25, 978, 660	4, 000, 371	. 154	. 154
II. Collectors:					
Distillation products—					
Coal-tar creosotes	2	5, 250	700	. 133	. 142
Blast-furnace oils	2	2, 117, 951	169, 102	. 080	. 074
Total distillation products	4	2, 123, 201	169, 802	. 080	. 052
Synthetic products—					
Ethyl xanthates	15	13, 734, 974	1, 446, 163	. 105	. 096
Butyl xanthates	2	3, 906, 780	192, 076	. 049	. 025
Amyl xanthates	5	8, 960, 612	77, 658	. 009	. 008
Xanthate derivatives	2	5, 017, 650	17, 874	. 004	. 001
Dicresol-dithiophosphoric acid	2	249, 678	35, 633	. 143	. 038
Sodium dicresol-dithiophosphate	2	1, 972, 349	51, 550	. 026	. 026
Sodium diethyl-dithiophosphate	1	8, 147, 764	105, 776	. 013	. 012
Total synthetic products	19	25, 978, 410	1, 926, 730	. 074	. 082
Total collectors	20	25, 978, 660	2, 096, 532	. 081	. 089
III. Acids [1] and alkalies: Lime	18	25, 973, 410	108, 499, 311	4. 177	4. 154
IV. Other inorganic reagents:[2]					
Sulphidizing—sodium sulphide	2	283, 066	59, 424	. 210	. 039
Depressing—cyanides	1	8, 147, 764	276, 644	. 034	. 038
Total reagents	20	25, 978, 660	114, 932, 282	4. 424	4. 410

[1] No acids consumed.

[2] No activating reagents consumed.

Metallurgical results.—The metallurgical results in the treatment of copper ore by straight flotation for 1929 to 1931 are given in Table 5. There was an improvement in the grade of concentrates produced, and the ratio of concentration and recoveries were slightly higher than in previous years.

Screen analysis and alkalinity.—The average screen analyses and alkalinities of the feed to flotation at copper plants for 1929 to 1931 are compared in Table 6. The average alkalinity increased in 1931.

Pulp density.—The average pulp density of the flotation feed, as reported by 15 plants treating 25,629,211 tons of ore, was 25.29 per cent solids. No comparative data for 1930 are available.

TABLE 5.—*Comparison of metallurgical results in the treatment by straight flotation of copper ores, 1929–1931*

	1929	1930	1931
Number of plants	30	36	20
Total ore treated.........dry tons	46, 928, 041	32, 454, 429	24, 496, 036
Gold content.........ounces	364, 752. 19	254, 045. 62	185, 302. 87
Do.........ounce per ton	0. 008	0. 008	0. 008
Silver content.........ounces	11, 104, 862	6, 642, 203	5, 456, 484
Do.........ounce per ton	0. 237	0. 199	0. 223
Copper content.........pounds	1, 318, 289, 930	876, 387, 325	683, 902, 734
Do.........per cent	1. 404	1. 310	1. 396
Concentrates produced.........dry tons	2, 480, 356	1, 681, 819	1, 157, 939
Gold content.........ounces	255, 275. 84	179, 337. 41	132, 661. 59
Do.........ounce per ton	0. 103	0. 107	0. 115
Silver content.........ounces	9, 712, 878	5, 778, 577	4, 898, 662
Do.........ounces per ton	3. 916	3. 436	4. 231
Copper content.........pounds	1, 154, 093, 479	782, 507, 042	619, 291, 816
Do.........per cent	23. 265	23. 263	26. 741
Ratio of concentration: Ore to concentrates	18. 92:1	19. 30:1	21. 15:1
Gold recovery.........per cent	69. 99	70. 59	71. 59
Silver recovery.........do	87. 47	87. 00	89. 78
Copper recovery.........do	87. 54	89. 29	90. 55

TABLE 6.—*Comparison of screen analyses and alkalinities in the treatment of copper ores, 1929–1931*

SCREEN ANALYSES OF FLOTATION FEED

	1929	1930	1931
Number of plants	22	31	18
Ore treated.........dry tons	46, 284, 546	33, 967, 845	25, 978, 225
+65 mesh.........per cent	7. 99	7. 80	6. 70
−65+100 mesh.........do	9. 44	11. 15	11. 42
−100+150 mesh.........do	9. 55	10. 42	11. 20
−150+200 mesh.........do	10. 23	10. 44	10. 00
−200 mesh.........do	62. 79	60. 19	60. 68

ALKALINITY OF FLOTATION CIRCUIT

Number of plants	11	18	9
Ore treated.........dry tons	(1)	26, 107, 615	19, 654, 724
Alkalinity of copper circuit.........pH units	7. 0–13. 0	9. 50	9. 73

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(1) Figures not available.

COPPER-IRON ORES

In 1931 3 plants treated sulphide copper-iron ores, making two or more concentrates. Two of these plants used large quantities of sulphuric acid in the iron flotation circuit. One plant produced zinc concentrates, copper concentrates, and iron concentrates.

Flotation reagents.—The reagents used in the treatment of copper-iron ores are given in Table 7. No marked changes are indicated by comparison with similar data for 1930.

TABLE 7.—*Consumption of reagents in the treatment of copper-iron ores in 1931*

[3 plants treating 579,647 tons of ore]

Reagent	Plants using	Ore treated, tons	Consumption of reagents, pounds		
			Total, 1931	Per ton	
				1931	1930
I. Frothers: Pine oils	3	579,647	63,025	0.109	0.078
II. Collectors:					
Distillation products—coal-tar creosotes	1	266,300	2,436	.009	.006
Synthetic products—					
Ethyl xanthates	3	579,647	92,276	.159	.185
Amyl xanthates	1	157,287	31,000	.197	.071
Dicresol-dithiophosphoric acid	2	422,360	70,011	.166	.126
Total synthetic products	3	579,647	193,287	.333	.295
Total collectors	3	579,647	195,723	.338	.299
III. Acids and alkalies:					
Acids—sulphuric acid	2	423,587	11,137,100	26.292	26.456
Alkalies—					
Lime	3	579,647	853,950	1.473	1.618
Cement	1	266,300	1,945,518	7.306	8.246
Total alkalies	3	579.647	2,799,468	4.830	7.728
IV. Other inorganic reagents:					
Activating—copper sulphate	2	422,360	191,722	.454	.664
Depressing—cyanides	1	156,060	2,352	.015	----------
Total reagents	3	579,647	14,389,390	24.824	35.053

Metallurgical results.—The 3 plants treating copper-iron ore in 1931 reported 579,647 tons of ore milled containing 13,195,089 pounds of copper, 5,995,038 pounds of zinc, and 337,992,932 pounds of iron. The production amounted to 30,104 tons of copper concentrates containing 10,889,990 pounds of copper, 1,357,650 pounds of zinc, and 21,101,628 pounds of iron; 2,378 tons of zinc concentrates containing 61,828 pounds of copper, 2,349,464 pounds of zinc, and 642,060 pounds of iron; and 213,151 tons of iron concentrates containing 1,296,062 pounds of copper, 964,346 pounds of zinc, and 220,929,022 pounds of iron. The ratio of concentration of ore to copper concentrates was 19.25:1, and the recovery of copper in copper concentrates was 82.53 per cent.

Screen analysis.—The average screen analysis reported by the 3 plants was 4.14 per cent +65 mesh, 8.92 per cent −65+100 mesh, 9.47 per cent −100+150 mesh, 11.69 per cent −150+200 mesh, and 65.78 per cent −200 mesh.

Alkalinity.—The average alkalinity reported by the 3 plants expressed in forms of pH units was as follows: Copper circuit, 9.30; zinc circuit, 10.70; and iron circuit, 6.92.

Pulp density.—The average pulp density reported by 2 plants treating 423,587 tons of ore was 30.47 per cent solids.

NATIVE COPPER ORES

In 1931 6 milling plants in Michigan reported the treatment of 3,570,748 tons of native copper ore. The ore was treated by a combination of gravity and flotation concentration, and 1 plant employed ammonia leaching in the treatment of sand tailings from the gravity concentration section of the mill while the slimes went to flotation. The material reaching the flotation sections of the 6 plants amounted to 1,802,048 tons.

Flotation reagents.—Table 8 gives the data on flotation reagents reported by the six plants. Two plants used pine-tar oils for the first time, and the per-ton consumption of ethyl xanthates was slightly higher than in 1930. No alkalies were used in 1931.

TABLE 8.—*Consumption of reagents in the treatment of native copper ores in 1931*

[6 plants treating 1,802,048 tons of ore]

Reagent	Plants using	Ore treated, tons	Consumption of reagents, pounds		
			Total, 1931	Per ton	
				1931	1930
I. Frothers: Pine oils	6	1,802,048	197,086	0.109	0.120
II. Collectors:					
Distillation products—					
Wood-tar creosotes	1	335,600	2,900	.009	.011
Pine-tar oils	2	937,600	5,200	.006	----------
Total distillation products	2	937,600	8,100	.009	.011
Synthetic products—					
Ethyl xanthates	5	1,542,048	163,720	.106	.078
Dicresol-dithiophosphoric acid	1	260,000	36,144	.139	.139
Total synthetic products	6	1,802,048	199,864	.111	.085
Total collectors	6	1,802,048	207,964	.115	.088
Total reagents	6	1,802,048	405,050	.225	.293

Metallurgical results.—Table 9 compares the metallurgical results obtained in the treatment of native copper ores in 1930 and 1931. The table does not include copper recovered from the ammonia leaching plant.

Screen analysis.—The average screen analysis as reported by five plants treating 1,662,048 tons was 14.94 per cent +65 mesh, 14.00 per cent −65+100 mesh, 7.84 per cent −100+150 mesh, 6.02 per cent −150+200 mesh, and 57.20 per cent −200 mesh.

TABLE 9.—*Comparison of metallurgical results in the treatment of native copper ores, 1930 and 1931*

		1930	1931
Number of plants		5	6
Total ore treated	dry tons	6,176,697	3,570,748
Copper content	pounds	169,733,360	126,722,164
Do	per cent	1.37	1.77
Gravity concentrates produced	dry tons	99,269	69,294
Copper content	pounds	140,778,802	102,464,095
Do	per cent	70.91	73.93
Flotation concentrates produced	dry tons	18,659	14,052
Copper content	pounds	15,783,937	13,658,401
Do	per cent	42.30	48.60
Ratio of concentration:			
Ore to gravity concentrates		62.22:1	51.53:1
Ore to flotation concentrates		331.03:1	254.11:1
Ore to all concentrates		52.38:1	42.84:1
Copper recoveries:			
In gravity concentrates	per cent	82.94	80.86
In flotation concentrates	do	9.30	10.78
In all concentrates	do	92.24	91.64

Alkalinity.—The five plants reported an average alkalinity expressed in terms of pH units of 8.47.

Pulp density.—Four plants treating 1,402,048 tons of ore reported an average pulp density of the flotation feed of 29.28 per cent solids.

COPPER-LEAD ORES

Only two plants reported the treatment of copper-lead ores in 1931. The data reported by these two plants have been included in the section on lead ore.

LEAD ORES

Mines in the United States produced 6,043,169 tons of lead ore in 1931, compared with about 8,150,000 tons in 1930. Nearly all the lead material (97.61 per cent) was concentrated, and all the remainder was first-class lead ore of smelting grade. Of the total lead ore concentrated (5,898,543 tons) 95.83 per cent was treated at combined gravity and flotation plants, 4.01 per cent at straight flotation plants, and 0.16 per cent at straight gravity plants. Most of the combined gravity and flotation plants discard part of the gravity-section tailings as a final waste product; the remainder, together with the primary slime, is advanced to flotation. This material and the feed to the straight flotation plants (including copper-lead ore) accounted for the 3,951,801 tons of ore treated at 28 plants, as given in Table 10.

Flotation reagents.—Table 10 gives the reagents used in the treatment of lead ores. Four collecting reagents (blast-furnace oils, sodium diethyl-dithiophosphate, sodium dibutyl-dithiophosphate, and oleic acid) were not reported in 1931, and two new collectors (xanthate derivatives and thioamino-phosphate) were used for the first time. The thioamino-phosphate was used at a plant treating oxidized lead ore. All four of the plants reporting amyl xanthates treated oxidized lead ores; this fact explains the large increase in the per-ton consumption of this reagent. The two plants reporting the use of sulphuric acid also treated oxidized lead ore, and the large decrease in the per-ton consumption was due to the closing of one plant ordinarily using nearly 6 pounds of acid per ton of ore treated.

Metallurgical results.—Table 11 compares the metallurgical results obtained in the treatment of lead ores in 1930 and 1931. It will be noted that the quantity of ore treated by straight flotation in 1931 (431,790 tons) is greater than that indicated in Table 1 due to inclusion of the copper-lead ore data which also accounts for the increase in the silver and copper content of the ore treated and for the improved recoveries of these metals. There was, however, a substantial improvement in the recovery of gold, lead, and zinc, indicating better performance at the straight flotation plants. No marked changes were indicated in the treatment of lead ores by combined gravity and flotation concentration.

Screen analysis and alkalinity.—Table 12 compares the average screen analyses and flotation circuit alkalinities in the flotation of lead ores from 1929 to 1931.

Pulp density.—Eleven plants treating 2,517,841 tons of ore reported an average pulp density of the flotation feed of 28.75 per cent solids.

TABLE 10.—*Consumption of reagents in the treatment of lead ores in 1931*

[28 plants treating 3,951,801 tons of ore]

Reagent	Plants using	Ore treated, tons	Consumption of reagents, pounds		
			Total, 1931	Per ton	
				1931	1930
I. Frothers:					
Pine oils	18	3, 047, 385	73, 842	0. 024	0. 035
Cresylic acid	17	3, 321, 298	610, 544	. 184	. 118
Total frothers	27	3, 951, 549	684, 386	. 173	. 145
II. Collectors:					
Distillation products—					
Coal-tar creosotes	6	493, 564	12, 926	. 026	. 021
Wood-tar creosotes	2	273, 741	16, 225	. 059	. 016
Total distillation products	7	583, 864	29, 151	. 050	. 021
Synthetic products—					
Ethyl xanthates	21	3, 447, 893	278, 898	. 081	. 099
Amyl xanthates	4	78, 349	77, 520	. 989	. 237
Xanthate derivatives	1	282, 879	6, 355	. 022	----------
Dicresol-dithiophosphoric acid	9	567, 348	43, 854	. 077	. 044
Thioamino-phosphate	1	252	40	. 159	----------
Thiocarbanilide	1	40, 851	400	. 010	. 004
Total synthetic products	26	3, 678, 060	407, 067	. 111	. 143
Total collectors	28	3, 951, 801	436, 218	. 110	. 149
III. Acids and alkalies:					
Acids—sulphuric acid	2	43, 594	5, 392	. 124	5. 864
Alkalies—					
Sodium carbonate	8	472, 615	41, 899	. 089	. 113
Lime	4	1, 117, 051	224, 921	. 201	. 327
Total alkalies	12	1, 589, 666	266, 820	. 168	. 335
IV. Other inorganic reagents:					
Sulphidizing—sodium sulphide	3	78, 097	316, 433	4. 052	2. 385
Activating—copper sulphate	5	1, 886, 034	123, 114	. 065	. 104
Depressing—					
Cyanides	8	2, 413, 493	76, 897	. 032	. 027
Sodium sulphite	1	500	150	. 300	. 008
Sodium silicate	3	57, 946	224, 031	3. 866	1. 510
Zinc sulphate	5	2, 243, 479	109, 900	. 049	. 095
Sodium sulphate	1	43, 342	6, 049	. 140	----------
Total depressing	13	3, 586, 629	417, 027	. 116	. 126
Total reagents	28	3, 951, 801	2, 249, 390	. 569	. 889

TABLE 11.—*Comparison of metallurgical results in the treatment of lead ores, 1930 and 1931*

	Method of concentration			
	Straight flotation		Combined gravity and flotation	
	1930	1931	1930	1931
Number of plants	23	15	15	13
Total ore treated ... dry tons	697,999	431,790	7,040,111	5,652,446
Gold content ... ounces	12,705.70	6,088.18	1,085.08	1,102.05
Do ... ounce per ton	0.018	0.014	Trace.	Trace.
Silver content ... ounces	2,387,539	3,974,490	3,329,036	2,803,283
Do ... ounces per ton	3.421	9.205	0.473	0.496
Copper content ... pounds	802,115	892,907	998,041	754,915
Do ... per cent	0.057	0.103	0.007	0.007
Lead content ... pounds	83,231,004	30,879,783	541,500,967	463,227,983
Do ... per cent	5.962	3.576	3.846	4.098
Zinc content ... pounds	269,000	30,092	41,487,473	30,405,867
Lead concentrates produced ... dry tons	71,790	31,341	380,109	334,591
Gold content ... ounces	9,317.54	4,831.08	964.39	896.11
Do ... ounce per ton	0.130	0.154	0.003	0.003
Silver content ... ounces	2,035,167	3,667,878	3,039,763	2,606,225
Do ... ounces per ton	28.349	117.031	7.997	7.789
Copper content ... pounds	531,594	788,983	825,138	613,902
Do ... per cent	0.370	1.259	0.109	0.092
Lead content ... pounds	75,714,437	28,274,804	508,784,913	438,326,045
Do ... per cent	52.733	45.108	66.926	65.502
Other concentrates produced ... dry tons	199	27	16,991	7,524
Gold content ... ounces	----------	----------	----------	36.00
Do ... ounce per ton	----------	----------	----------	0.005
Silver content ... ounces	686	500	123,417	48,276
Do ... ounces per ton	3.447	18.519	7.264	6.416
Copper content ... pounds	----------	----------	44,584	21,445
Do ... per cent	----------	----------	0.131	0.143
Lead content ... pounds	25,589	11,500	832,014	442,340
Do ... per cent	6.429	21.296	2.443	2.940
Zinc content ... pounds	146,832	22,161	16,805,368	8,200,831
Do ... per cent	36.892	41.039	49.454	54.498
Ratio of concentration: Ore to lead concentrates	9.72:1	13.78:1	18.52:1	16.89:1
Recoveries:				
Gold in lead concentrates ... per cent	73.33	79.35	88.88	81.31
Silver in lead concentrates ... do	85.24	92.29	91.31	92.97
Copper in lead concentrates ... do	66.27	88.36	82.68	81.32
Lead in lead concentrates ... do	90.97	91.56	93.96	94.62
Gold in all concentrates ... do	73.33	79.35	88.88	84.58
Silver in all concentrates ... do	85.27	92.30	95.02	94.69
Copper in all concentrates ... do	66.27	88.36	87.14	84.16
Lead in all concentrates ... do	91.00	91.60	94.11	94.72
Zinc in all concentrates ... do	54.58	73.64	40.51	26.97

TABLE 12.—*Comparison of screen analyses and alkalinities in the treatment of lead ores, 1929–1931*

SCREEN ANALYSES OF FLOTATION FEED

	1929	1930	1931
Number of plants	14	20	19
Ore treated ... dry tons	1,105,830	5,159,705	3,848,408
+65 mesh ... per cent	3.07	4.98	5.33
−65+100 mesh ... do	8.12	10.34	9.30
−100+150 mesh ... do	10.75	10.24	10.79
−150+200 mesh ... do	11.08	11.31	11.70
−200 mesh ... do	66.98	63.13	62.88

ALKALINITY OF FLOTATION CIRCUITS

Number of plants	7	18	15
Ore treated ... dry tons	(1)	5,062,388	3,663,931
Alkalinity of lead circuit ... pH units	7.00−8.00	8.11	8.16
Alkalinity of zinc circuit ... do	(1)	[2] 9.09	[3] 8.68

[1] Not determined.

[2] 2 plants treating 1,776,978 tons of ore.

[3] 4 plants treating 1,871,682 tons of ore.

LEAD-ZINC ORES

Mines in the United States produced 6,023,825 tons of lead-zinc ore (including lead-zinc-iron ore) in 1931, compared with about 10,509,000 tons in 1930. Nearly 96 per cent of the total lead-zinc ore was treated by concentration, and most of the remainder was treated at magnetic separation plants. Of the total ore concentrated 27 per cent was treated at straight flotation plants, 71 per cent at combined gravity and flotation plants, and 2 per cent at straight gravity plants. Most of the combined gravity and flotation plants are in the tri-State region.

Flotation reagents.—Table 13 summarizes the flotation reagents used in the treatment of lead-zinc ores. Comparison of this table with similar data for 1930 indicates no important changes.

TABLE 13.—*Consumption of reagents in the treatment of lead-zinc ores in 1931*

[52 plants treating 2,128,874 tons of ore]

Reagent	Plants using	Ore treated, tons	Consumption of reagents, pounds		
			Total, 1931	Per ton	
				1931	1930
I. Frothers:					
Pine oils	42	1, 990, 441	195, 446	0. 098	0. 119
Cresylic acid	33	1, 441, 941	139, 063	. 096	. 103
Orthotoluidine	1	112, 704	900	. 008	. 204
Total frothers	52	2, 128, 874	335, 409	. 158	. 190
II. Collectors:					
Distillation products—					
Coal-tar creosotes	25	1, 185, 045	346, 685	. 293	. 258
Wood-tar creosotes	5	725, 115	49, 755	. 069	. 113
Water-gas tars	1	9, 911	1, 980	. 200	---------
Petroleum products	1	147, 505	14, 000	. 095	. 097
Total distillation products	28	1, 363, 261	412, 420	. 303	. 327
Synthetic products—					
Ethyl xanthates	45	1, 728, 715	349, 938	. 202	. 197
Butyl xanthates	1	184, 502	20, 850	. 113	. 044
Amyl xanthates	8	701, 771	100, 196	. 143	. 092
Xanthate derivatives	5	417, 627	40, 535	. 097	. 027
Dicresol-dithiophosphoric acid	23	889, 506	62, 229	. 070	. 079
Sodium dicresol-dithiophosphate	9	390, 927	20, 930	. 054	. 135
Thiocarbanilide	5	372, 662	37, 164	. 100	. 111
Total synthetic products	50	1, 922, 733	631, 842	. 329	. 284
Total collectors	52	2, 128, 874	1, 044, 262	. 491	. 463
III. Acids and alkalies:					
Acids—sulphuric acid	3	54, 926	463	. 008	---------
Alkalies—					
Sodium carbonate	17	937, 013	764, 885	. 816	. 942
Sodium bicarbonate	1	58, 636	14, 659	. 250	. 250
Sodium hydroxide	1	147, 505	8, 400	. 057	. 304
Lime	15	1, 167, 048	2, 215, 770	1. 899	2. 761
Total alkalies	26	1, 420, 386	3, 003, 714	2. 115	2. 532
IV. Other inorganic reagents:					
Sulphidizing—sodium sulphide	2	442, 989	240, 984	. 544	. 549
Activating—copper sulphate	52	2, 128, 874	2, 116, 431	. 994	1. 051
Depressing—					
Cyanides	14	914, 237	221, 818	. 243	. 250
Sodium sulphite	3	317, 545	368, 021	1. 159	1. 161
Sodium silicate	5	245, 884	37, 751	. 154	. 209
Zinc sulphate	17	1, 241, 253	895, 903	. 722	. 876
Sodium bichromate	1	41, 079	14, 379	. 350	. 177
Total depressing	26	1, 652, 346	1, 537, 872	. 931	1. 243
Miscellaneous—					
Sodium chloride	1	80, 968	100, 645	1. 243	. 102
Sodium bisulphite	1	9, 911	14, 170	1. 430	---------
Total reagents	52	2, 128, 874	8, 393, 950	3. 943	4. 625

TABLE 14.—*Comparison of metallurgical results in the treatment of complex lead-zinc-iron ores, 1930 and 1931*

	Method of concentration			
	Straight flotation		Combined gravity and flotation	
	1930	1931	1930	1931
Number of plants	29	21	26	31
Total ore treated, dry tons	2, 475, 432	1, 540, 855	3, 000, 528	3, 099, 176
Gold content, ounces	82, 031. 01	87, 094. 73	5, 179. 22	2, 647. 00
Do, ounce per ton	0. 033	0. 057	0. 002	0. 001
Silver content, ounces	14, 250, 967	7, 666, 806	714, 763	479, 344
Do, ounces per ton	5. 757	4. 976	0. 238	0. 155
Copper content, pounds	15, 976, 760	10, 909, 734	830, 475	686, 275
Do, per cent	0. 323	0. 354	0. 014	0. 011
Lead content, pounds	342, 563, 646	222, 199, 426	77, 640, 339	60, 520, 995
Do, per cent	6. 919	7. 210	1. 298	0. 976
Zinc content, pounds	420, 723, 844	301, 925, 036	209, 312, 838	277, 599, 498
Do, per cent	8. 498	9. 797	3. 488	4. 479
Lead concentrates produced, dry tons	265, 711	170, 498	46, 726	32, 307
Gold content, ounces	47, 812. 94	52, 696. 23	1, 755. 13	1, 104. 57
Do, ounce per ton	0. 180	0. 309	0. 038	0. 034
Silver content, ounces	10, 532, 100	6, 089, 075	431, 370	271, 257
Do, ounces per ton	39. 637	35. 713	9. 232	8. 396
Copper content, pounds	9, 788, 510	7, 036, 522	318, 420	218, 252
Do, per cent	1. 842	2. 064	0. 341	0. 338
Lead content, pounds	294, 376, 483	195, 654, 161	59, 045, 314	39, 811, 171
Do, per cent	55. 394	57. 377	63. 182	61. 614
Zinc content, pounds	39, 038, 750	22, 337, 188	3, 050, 500	3, 290, 402
Do, per cent	7. 346	6. 551	3. 264	5. 092
Zinc concentrates produced, dry tons	331, 383	221, 926	153, 994	203, 215
Gold content, ounces	9, 274. 05	6, 542. 85	794. 01	403. 00
Do, ounce per ton	0. 028	0. 029	0. 005	0. 002
Silver content, ounces	1, 975, 295	714, 510	105, 229	84, 412
Do, ounces per ton	5. 961	3. 220	0. 683	0. 415
Copper content, pounds	3, 221, 234	2, 306, 293	247, 429	247, 928
Do, per cent	0. 486	0. 520	0. 080	0. 061
Lead content, pounds	18, 670, 949	8, 941, 910	5, 551, 083	7, 279, 007
Do, per cent	2. 817	2. 015	1. 802	1. 791
Zinc content, pounds	345, 265, 710	245, 893, 190	173, 121, 987	236, 364, 862
Do, per cent	52. 095	55. 400	56. 211	58. 156
Iron concentrates produced, dry tons	64, 535	80, 046	3, 721	2, 000
Gold content, ounces	8, 664. 66	8, 679. 77	52. 90	38. 91
Silver content, do	168, 495	68, 396	4, 005	2, 038
Copper content, pounds	281, 671	212, 284	1, 021	3, 646
Lead content, do	2, 335, 350	2, 172, 799	43, 366	20, 409
Zinc content, do	4, 618, 840	8, 325, 067	148, 840	102, 000
Ratio of concentration:				
Ore to lead concentrates	9. 32:1	9. 04:1	64. 21:1	95. 93:1
Ore to zinc concentrates	7. 47:1	6. 94:1	19. 48:1	15. 25:1
Ore to iron concentrates	38. 36:1	19. 25:1	-----------	-----------
Ore to all concentrates	3. 80:1	3. 26:1	14. 68:1	13. 05:1
Recoveries:				
Gold in lead concentrates, per cent	58. 29	60. 50	33. 89	41. 73
Gold in zinc concentrates, do	11. 31	7. 51	15. 33	15. 22
Gold in iron concentrates, do	10. 56	9. 97	1. 02	1. 47
Gold in all concentrates, do	80. 16	77. 98	50. 24	58. 42
Silver in lead concentrates, do	73. 90	79. 42	60. 35	56. 59
Silver in zinc concentrates, do	13. 86	9. 32	14. 72	17. 61
Silver in iron concentrates, do	1. 18	. 89	. 56	. 42
Silver in all concentrates, do	88. 94	89. 63	75. 63	74. 62
Copper in lead concentrates, do	61. 27	64. 50	38. 34	31. 80
Copper in zinc concentrates, do	20. 16	21. 14	29. 79	36. 13
Copper in iron concentrates, do	1. 76	1. 94	. 01	. 53
Copper in all concentrates, do	83. 21	87. 58	68. 14	68. 46
Lead in lead concentrates, do	85. 93	88. 05	76. 05	65. 78
Lead in zinc concentrates, do	5. 45	4. 03	7. 15	12. 03
Lead in iron concentrates, do	. 68	. 98	. 06	. 03
Lead in all concentrates, do	92. 06	93. 06	83. 26	77. 84
Zinc in lead concentrates, do	9. 28	7. 40	1. 46	1. 18
Zinc in zinc concentrates, do	82. 06	81. 44	82. 71	85. 15
Zinc in iron concentrates, do	1. 10	2. 76	. 07	. 04
Zinc in all concentrates, do	92. 44	91. 60	84. 24	86. 37

Metallurgical results.—Table 14 summarizes the available metallurgical data on the treatment of lead-zinc ores in 1930 and 1931. Comparison of the results obtained by straight flotation in 1931 with those in 1930 indicates improved over-all recoveries in silver, copper, and lead.

Screen analysis and alkalinity.—Table 15 compares the average screen analyses and alkalinities of flotation lead-zinc-iron circuits from 1929 to 1931. It is interesting to note that although the average alkalinities of the lead circuit and iron circuit are increasing the average alkalinity of the zinc circuit is decreasing.

Pulp density.—The average pulp density of the flotation feed as reported by 16 plants treating 1,052,663 tons of lead-zinc ore was 33.03 per cent solids.

TABLE 15.—*Comparison of screen analyses and alkalinities in the treatment of lead-zinc ores, 1929–1931*

SCREEN ANALYSES OF FLOTATION FEED

	1929	1930	1931
Number of plants	24	25	24
Ore treated ... dry tons	3, 008, 945	2, 552, 686	1, 675, 424
+65 mesh ... per cent	5. 23	5. 69	4. 68
−65+100 mesh ... do	7. 58	8. 15	8. 55
−100+150 mesh ... do	8. 43	8. 30	8. 88
−150+200 mesh ... do	11. 83	11. 47	12. 91
−200 mesh ... do	66. 93	66. 39	64. 98

ALKALINITY OF FLOTATION CIRCUITS

	1929	1930	1931
Number of plants	20	36	20
Ore treated ... dry tons	2, 734, 731	2, 453, 978	1, 308, 180
Alkalinity:			
Lead circuit ... pH units	7. 93	7. 92	7. 99
Zinc circuit ... do	8. 41	8. 36	8. 23
Iron circuit ... do	[1] 7. 99	[2] 8. 00	[3] 8. 07

[1] 2 plants treating 484,851 tons of ore.
[2] 3 plants treating 578,485 tons of ore.
[3] 4 plants treating 486,682 tons of ore.

ZINC ORES

Mines in the United States produced 3,912,958 tons of zinc ore in 1931, compared with about 6,194,000 tons in 1930. Nearly 82 per cent of the material was concentrated, and most of the remainder was treated by magnetic separation. Nearly 87 per cent of the total zinc ore concentrated was treated at plants using a combination of gravity and flotation concentration. Most of the remainder (11 per cent of the total) was treated by straight flotation, and only 2 per cent was treated at straight gravity concentration plants.

Flotation reagents.—The flotation reagents used in the treatment of zinc ores are summarized in Table 16. There were no marked changes in the per-ton consumption of the reagents reported; but several reagents used in 1930 were not reported in 1931, including wood-tar creosotes, petroleum products, blast-furnace oils, alpha-naphthalamine, sodium hydroxide, sodium sulphide, sodium silicate, and linseed oil.

TABLE 16.—*Consumption of reagents in the treatment of zinc ores in 1931*

[18 plants treating 905,456 tons of ore]

Reagent	Plants using	Ore treated, tons	Consumption of reagents, pounds		
			Total, 1931	Per ton	
				1931	1930
I. Frothers:					
Pine oils	16	875, 999	133, 388	0. 152	0. 132
Cresylic acid	7	114, 449	10, 336	. 090	. 091
Total frothers	18	905, 456	143, 724	. 159	. 149
II. Collectors:					
Distillation products—coal-tar creosotes	9	686, 948	127, 825	. 186	. 128
Synthetic products—					
Ethyl xanthates	11	499, 540	62, 284	. 125	. 183
Amyl xanthates	3	245, 830	2, 181	. 009	. 009
Dicresol-dithiophosphoric acid	8	123, 417	35, 364	. 287	. 083
Sodium dicresol-dithiophosphate	11	683, 474	33, 492	. 049	. 079
Thiocarbanilide	1	289, 517	5, 400	. 019	. 114
Total synthetic products	18	905, 456	138, 721	. 153	. 194
Total collectors	18	905, 456	266, 546	. 294	. 276
III. Acids [1] and alkalies:					
Alkalies—					
Sodium carbonate	1	25, 705	44, 550	1. 733	. 693
Lime	6	206, 723	1, 032, 940	4. 997	3. 582
Total alkalies	6	206, 723	1, 077, 490	5. 212	1. 791
IV. Other inorganic reagents:					
Activating—copper sulphate	18	905, 456	880, 080	. 972	1. 017
Depressing—cyanides	1	23, 450	6, 000	. 256	. 220
Miscellaneous—sodium aluminate	1	21, 700	870	. 040	----------
Total reagents	18	905, 456	2, 374, 710	2. 623	2. 934

[1] No acids consumed.

Metallurgical results.—Table 17 compares the metallurgical results obtained in the treatment of zinc ores in 1930 and 1931. A large number of plants treating zinc ore in 1930 were idle in 1931, including certain plants which treated ores containing recoverable quantities of gold, silver, and copper. No gold, silver, or copper was reported recovered from zinc ores in 1931. The recoveries of lead and zinc were substantially the same as in 1930.

Screen analysis and alkalinity.—Table 18 shows that the average screen analysis in 1931 was considerably improved over that in 1930 and that the average alkalinity of both the lead and zinc circuits was somewhat lower in 1931.

Pulp density.—Nine plants treating 734,401 tons of zinc ore reported an average pulp density of the flotation feed of 32.45 per cent solids.

TABLE 17.—*Comparison of metallurgical results in the treatment of zinc ores, 1930 and 1931*

		Method of concentration		
		All methods	Straight flotation	Combined gravity and flotation
		1930	1931	1931
Number of plants		22	4	14
Total ore treated	dry tons	2, 218, 923	356, 861	2, 451, 154
Gold content	ounces	653. 00		
Do	ounce per ton	Trace.		
Silver content	ounces	524, 008		
Do	ounce per ton	0. 236		
Copper content	pounds	347, 629		
Do	per cent	0. 008		
Lead content	pounds	4, 200, 822	83, 600	3, 345, 370
Do	per cent	0. 095	0. 012	0. 068
Zinc content	pounds	175, 108, 475	64, 179, 243	132, 495, 721
Do	per cent	3. 946	8. 992	2. 703
Lead concentrates produced	dry tons	1, 421		296
Gold content	ounces	128. 68		
Do	ounce per ton	0. 091		
Silver content	ounces	188, 227		
Do	ounces per ton	132. 461		
Copper content	pounds	103, 889		
Do	per cent	3. 605		
Lead content	pounds	1, 889, 298		426, 270
Do	per cent	66. 478		72. 005
Zinc content	pounds	180, 386		18, 250
Do	per cent	6. 347		3. 083
Zinc concentrates produced	dry tons	125, 813	45, 606	86, 762
Gold content	ounces	225. 79		
Do	ounce per ton	0. 002		
Silver content	ounces	260, 960		
Do	ounces per ton	2. 704		
Copper content	pounds	196, 371		
Do	per cent	0. 078		
Lead content	pounds	1, 299, 308	72, 120	1, 403, 230
Do	per cent	5. 164	0. 079	0. 809
Zinc content	pounds	147, 664, 574	55, 388, 349	106, 326, 359
Do	per cent	58. 684	60. 725	61. 275
Ratio of concentration:				
Ore to zinc concentrates		17. 64:1	7. 82:1	28. 25:1
Ore to all concentrates		17. 44:1	7. 82:1	28. 16:1
Recoveries:				
Gold in lead concentrates	per cent	19. 71		
Gold in zinc concentrates	do	34. 58		
Gold in all concentrates	do	54. 29		
Silver in lead concentrates	do	35. 92		
Silver in zinc concentrates	do	49. 80		
Silver in all concentrates	do	85. 72		
Copper in lead concentrates	do	29. 88		
Copper in zinc concentrates	do	56. 49		
Copper in all concentrates	do	86. 37		
Lead in lead concentrates	do	44. 97		12. 74
Lead in zinc concentrates	do	30. 93	86. 27	41. 95
Lead in all concentrates	do	75. 90	86. 27	54. 69
Zinc in lead concentrates	do	. 10		. 01
Zinc in zinc concentrates	do	84. 33	86. 30	80. 25
Zinc in all concentrates	do	84. 43	86. 30	80. 26

TABLE 18.—*Comparison of screen analyses and alkalinities in the treatment of zinc ores, 1930 and 1931*

SCREEN ANALYSES OF FLOTATION FEED

	1930	1931
Number of plants	9	4
Total ore treated ... dry tons	664, 808	620, 673
+65 mesh ... per cent	11. 40	8. 36
−65+100 mesh ... do	14. 62	17. 81
−100+150 mesh ... do	12. 47	12. 02
−150+200 mesh ... do	12. 71	10. 93
−200 mesh ... do	48. 80	50. 88

ALKALINITY OF FLOTATION CIRCUITS

Lead circuit:		
Number of plants	5	3
Ore treated ... dry tons	126, 548	68, 249
Alkalinity ... pH units	8. 74	7. 34
Zinc circuit:		
Number of plants	17	10
Ore treated ... dry tons	573, 463	505, 884
Alkalinity ... pH units	8. 82	8. 57

GOLD AND SILVER ORES

About 4,134,000 tons of ore valuable chiefly for its gold or silver content were mined in the United States in 1931. Most (3,428,960 tons) of this ore was treated at plants using amalgamation or cyanidation as the chief means of recovery; certain of these plants employ some method of concentration in conjunction with amalgamation or cyanidation equipment. A large part (303,377 tons) of the remaining gold and silver ore was shipped direct to various smelting plants, chiefly as a siliceous fluxing material. The rest (401,739 tons) was treated by concentration, mostly by flotation.

Flotation reagents.—During 1931, 33 plants treating gold and silver ores used flotation equipment in the treatment of 609,183 tons of ore. Table 1 indicates that only 396,684 tons of this material were treated by straight flotation and only 570 tons by combined gravity and flotation. The remainder of the 609,183 tons is made up of ore treated at plants using amalgamation or cyanidation in conjunction with flotation. The reagents employed in the treatment of this ore are given in Table 19. There was a marked decrease in the use of distillation collectors and an increase in the use of synthetic collectors, chiefly amyl xanthates and dicresol-dithiophosphoric acid. There was an interesting decrease in the per-ton consumption of synthetic collectors. The use of soluble starch was reported in 1931 for the first time.

TABLE 19.—*Consumption of reagents in the treatment of gold and silver ores in 1931*

[33 plants treating 609,183 tons of ore]

Reagent	Plants using	Ore treated, tons	Consumption of reagents, pounds		
			Total, 1931	Per ton	
				1931	1930
I. Frothers:					
Pine oils	29	550,408	70,668	0.128	0.097
Cresylic acid	8	144,793	13,056	.090	.066
Orthotoluidine	1	2,174	43	.020	.159
Total frothers	33	609,183	83,767	.138	.111
II. Collectors:					
Distillation products—					
Coal-tar creosotes	3	1,097	290	.264	.046
Petroleum products	2	5,554	1,799	.324	.414
Water-gas tars	1	3,380	845	.250	.250
Total distillation products	5	6,651	2,934	.441	.143
Synthetic products—					
Ethyl xanthates	23	286,177	17,924	.063	.120
Amyl xanthates	13	430,041	12,349	.029	.084
Dicresol-dithiophosphoric acid	7	209,602	15,081	.072	.049
Sodium dicresol-dithiophosphate	1	25,118	200	.008	.104
Thiocarbanilide	1	2,174	11	.005	
Total synthetic products	31	608,283	45,565	.075	.161
Total collectors	33	609,183	48,499	.080	.208
III. Acids [1] and alkalies:					
Alkalies—					
Sodium carbonate	6	62,703	26,518	.423	1.472
Lime	9	212,623	70,770	.333	.516
Total alkalies	15	275,326	97,288	.353	.800
IV. Other inorganic reagents:					
Sulphidizing—sodium sulphide	8	84,834	25,974	.306	.624
Activating—copper sulphate	6	268,347	13,561	.051	.100
Depressing—					
Cyanides	1	25,118	5,380	.214	.282
Zinc sulphate	1	25,118	13,000	.518	.964
Total depressing	1	25,118	18,380	.732	1.896
Miscellaneous—starch	2	143,221	36,068	.252	
Total reagents	33	609,183	323,537	.531	.932

[1] No acids consumed.

Metallurgical results.—For the purpose of comparing average metallurgical data the gold and silver mills have been separated into two groups—those using concentration equipment without amalgamation or cyanidation and those using some combination of concentration and amalgamation or cyanidation. Of the 18 mills in the first group in 1931, 16 used straight flotation and 2 a combination of gravity and flotation. A comparison of the results at these mills in 1930 and 1931 is given in Table 20. The recovery of gold at these plants increased from 75.26 per cent in 1930 to 81.26 per cent in 1931, and the grade of the concentrates produced increased from 3.427 ounces of gold per ton in 1930 to 7.525 ounces in 1931. Of the 15 plants in the second group, 4 used a combination of gravity and flotation concentration with amalgamation and 11 a combination of straight flotation and amalgamation. The quantity of ore treated by mills in the second group was decidedly greater in 1931 than in 1930 due to adoption of flotation as a supplementary operation at several gold mills in California. The over-all recovery of gold at the plants in the second group was lower than in 1930 but was considerably higher than that obtained at plants not using amalgamation.

Screen analysis.—The average screen analysis of the flotation feed at gold and silver mills in 1930 and 1931 is compared in Table 21. The large increase in the quantity of ore reported is due to the inclusion in 1931 for the first time of ore treated at several California gold mills. The average feed was considerably coarser in 1931 than in 1930.

Alkalinity and pulp density.—The average alkalinity, measured in terms of pH units, as reported by 8 plants treating 259,338 tons of ore, was 8.57. The average pulp density of the flotation feed at 8 plants treating 309,466 tons of ore was 32.56 per cent solids. No comparative data for 1930 are available.

TABLE 20.—*Comparison of metallurgical results in the treatment of gold and silver ores, 1930 and 1931*

	Method of concentration			
	Straight concentration		Combined concentration and amalgamation or cyanidation	
	1930	1931	1930	1931
Number of plants	20	18	6	15
Total ore treated ... dry tons	153, 038	226, 459	66, 166	802, 309
Gold content ... ounces	38, 409. 47	42, 697. 36	28, 747. 92	196, 174. 21
Do ... ounce per ton	0. 251	0. 189	0. 435	0. 245
Silver content ... ounces	921, 300	406, 395	301, 353	641, 938
Do ... ounces per ton	6. 020	1. 795	4. 555	0. 800
Copper content ... pounds	65, 450	129, 572	47, 298	2, 107, 256
Do ... per cent	0. 021	0. 029	0. 036	0. 131
Lead content ... pounds	35, 480	418, 729	564, 325	1, 408, 264
Do ... per cent	0. 012	0. 092	0. 426	0. 088
Zinc content ... pounds	----------	----------	290, 576	----------
Do ... per cent	----------	----------	0. 220	----------
Concentrates produced ... dry tons	8, 436	4, 611	2, 581	17, 228
Gold content ... ounces	28, 907. 73	34, 696. 83	9, 576. 77	71, 233. 82
Do ... ounces per ton	3. 427	7. 525	3. 711	4. 135
Silver content ... ounces	778, 954	305, 153	55, 603	480, 829
Do ... ounces per ton	92. 337	66. 179	21. 543	27. 910
Copper content ... pounds	42, 705	114, 920	32, 085	1, 712, 187
Do ... per cent	0. 253	1. 246	0. 622	4. 969
Lead content ... pounds	28, 060	324, 503	305, 499	1, 138, 189
Do ... per cent	0. 166	3. 519	5. 918	3. 303
Zinc content ... pounds	----------	----------	207, 642	----------
Do ... per cent	----------	----------	4. 023	----------
Bullion:				
Gold content ... ounces	----------	----------	18, 029. 25	109, 756. 22
Silver content ... do	----------	----------	211, 632	37, 894
Ratio of concentration: Ore to all concentrates	18. 14:1	49. 11:1	25. 64:1	46. 57:1
Recoveries:				
Gold in all concentrates ... per cent	75. 26	81. 26	33. 31	36. 31
Gold in bullion ... do	----------	----------	62. 71	55. 95
Gold in all products ... do	75. 26	81. 26	96. 03	92. 26
Silver in all concentrates ... do	84. 55	75. 09	18. 45	74. 90
Silver in bullion ... do	----------	----------	70. 23	5. 91
Silver in all products ... do	84. 55	75. 09	88. 68	80. 81
Copper in all concentrates ... do	65. 25	88. 69	67. 84	81. 25
Lead in all concentrates ... do	79. 09	77. 50	54. 14	80. 82
Zinc in all concentrates ... do	----------	----------	71. 46	----------

TABLE 21.—*Comparison of screen analyses of flotation feed in the treatment of gold and silver ores, 1930 and 1931*

	1930	1931
Number of plants	8	9
Total ore treated ... dry tons	172, 292	359, 919
+65 mesh ... per cent	1. 44	5. 58
−65+100 mesh ... do	7. 81	9. 53
−100+150 mesh ... do	11. 64	12. 52
−150+200 mesh ... do	20. 33	16. 07
−200 mesh ... do	58. 78	56. 30

SUMMARY OF REAGENT CONSUMPTION

TABLE 22.—*Summary of reagent consumption in 1931, by classes of ores*

	Copper	Cop-per-iron	Copper (native)	Lead	Lead-zinc	Zinc	Gold and silver
Number of plants	20	3	6	28	52	18	33
Total ore treated ... dry tons	25, 978, 660	579, 647	1, 802, 048	3, 951, 801	2, 128, 874	905, 456	609, 183
Reagents used per ton of ore treated:							
I. Frothers ... pounds	0. 154	0. 109	0. 109	0. 173	0. 158	0. 159	0. 138
II. Collectors—							
Distillation ... do	. 080	. 009	. 009	. 050	. 303	. 186	. 441
Synthetic ... do	. 074	. 333	. 111	. 111	. 329	. 153	. 075
III. Acids and alkalies—							
Acids ... do	----------	26. 292	---------	. 124	. 008	--------	--------
Alkalies ... do	4. 177	4. 830	---------	. 168	2. 115	5. 212	. 353
IV. Other inorganic reagents—							
Sulphidizing ... do	. 210	--------	---------	4. 052	. 544	--------	. 306
Activating ... do	----------	. 454	---------	. 065	. 994	. 972	. 051
Depressing ... do	. 034	. 015	---------	. 116	. 931	. 256	. 732
Miscellaneous ... do	----------	--------	---------	---------	1. 263	. 040	. 252
Total reagents ... do	4. 424	24. 824	. 225	. 569	3. 943	2. 623	. 531

GOLD, SILVER, COPPER, LEAD, AND ZINC IN IDAHO[1]

(MINE REPORT)

By C. N. GERRY and T. H. MILLER[2]

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SUMMARY

The value of the mine production of gold, silver, copper, lead, and zinc in Idaho decreased from $21,494,867 in 1930 to $11,418,013 in 1931, the smallest in any year since detailed records were started in 1903 and 55 per cent less than the average annual value ($25,201,337) for the decade 1922 to 1931. The output of each metal decreased decidedly; lead decreased more than 69,000,000 pounds and zinc more than 36,000,000 pounds. The general decrease in metal production was due chiefly to the continued drop in average price of silver, copper, lead, and zinc, which resulted in curtailment of operations at many large producing mines and suspension at others. Since 1863 Idaho's output of the five metals has been as follows: Gold, $137,889,762; silver, 333,668,941 fine ounces; copper, 158,517,589 pounds; lead, 9,266,546,477 pounds; and zinc, 883,463,863 pounds. The total value has amounted to $971,420,046, more than half of which represents the value of lead. In 1931 Idaho was second in output of silver after Utah, second in lead after Missouri, and eighth in zinc after New Jersey, Oklahoma, Kansas, Utah, New Mexico, Tennessee, and New York. Dividends for 1931, taken largely from annual printed reports of the companies, were about $1,100,000.

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[1] Work on manuscript completed September, 1932.

[2] The assistance of Paul Luff and Jeannette Froiseth, of the Bureau of Mines, is appreciated.

Although the metal output of Idaho in 1931 was derived from 31 counties, most of the silver, copper, lead, and zinc were recovered from ore and concentrates from Shoshone County (Coeur d'Alene region), whose metal output was valued at $10,809,561, a decrease of $8,919,326 from 1930.

During the decade 1922 to 1931, 45.8 per cent of the gold was derived from placers and 37.7 per cent from dry and siliceous ore; 60.4 per cent of the silver and 71.2 per cent of the lead came from lead ore, and most of the remaining silver and lead came from lead-zinc ore and copper-lead ore. Silver from copper-lead ore, largely from the Sunshine mine, has increased decidedly in recent years.

In 1931, 60 per cent of the total gold produced was derived from dry gold ore; more than 28 per cent came from placers; and most of the remainder came from lead-zinc ore and lead ore. More than 45 per cent of the silver and nearly 71 per cent of the lead came from lead ore; nearly all the remainder of the silver came from copper-lead ore and lead-zinc ore, and nearly all the remainder of the lead came from lead-zinc ore.

The report[3] of the mine inspector of Idaho contains notes on the progress of the mining industry, lists the active producing and developing companies by counties, includes accident statistics, and gives an interesting bibliography for each county. The inspector estimates that 4,500 men were employed in Idaho mines in 1931.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064
1928	.585	.144	.058	.061
1929	.533	.176	.063	.066
1930	$0.385	$0.130	$0.050	$0.048
1931	.290	.091	.037	.038

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1927–1931, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1927	148	70	2,018,325	15,315.67	$316,603	8,901,409	$5,047,099
1928	151	56	2,054,329	20,980.38	433,703	8,998,330	5,264,023
1929	147	51	2,174,125	20,247.11	418,545	9,414,403	5,017,877
1930	131	61	1,944,900	21,445.07	443,309	9,420,639	3,626,946
1931	136	160	1,299,927	18,361.36	379,563	7,220,923	2,094,068

Campbell, Stewart, Thirty-Third Annual Report of the Mining Industry of Idaho, for 1931, 298 pages.

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1927–1931, in terms of recovered metals—Continued

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1927	2, 173, 163	$284, 684	302, 038, 423	$19, 028, 421	53, 556, 345	$3, 427, 606	$28, 104, 413
1928	2, 072, 165	298, 392	290, 645, 905	16, 857, 462	62, 526, 648	3, 814, 126	26, 667, 706
1929	5, 131, 438	903, 133	297, 389, 488	18, 735, 538	91, 350, 807	6, 029, 153	31, 104, 246
1930	3, 111, 555	404, 502	268, 115, 963	13, 405, 798	75, 298, 172	3, 614, 312	21, 494, 867
1931	1, 144, 915	104, 187	198, 729, 228	7, 352, 981	39, 137, 212	1, 487, 214	11, 418, 013

Gold and silver produced at placer mines in Idaho, 1927–1931

Year	Gold		Silver		Year	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value		Fine ounces	Value	Fine ounces	Value
1927	7, 520. 33	$155, 459	2, 306	$1, 308	1930	3, 987. 45	$82, 428	1, 355	$522
1928	8, 191. 63	169, 336	2, 538	1, 485	1931	5, 213. 52	107, 773	1, 848	536
1929	4, 129. 92	85, 373	1, 419	756					

GOLD

The production of gold in Idaho was $379,563 in 1931, a decrease of more than 14 per cent from 1930 and less than the average annual output ($453,142) for the decade 1922 to 1931. The decrease of more than 3,000 ounces resulted chiefly from the decline in output of gold from the Sherman Howe mine near Burgdorf, Idaho County, and from the placer property of the Idaho Gold Dredging Corporation at Centerville, Boise County; there was also a large decrease from the properties of the Idawa Gold Mining Co. at Placerville and the Mackay Metals (Inc.) at Mackay. A much larger decrease in gold output was prevented by activity of the Idaho Gold Dredging Co. at its new dredge near Warren, Idaho County. Lode mines yielded $271,790 in gold in 1931, a decrease from $360,881 in 1930; placers yielded $107,773, an increase from $82,428 in 1930. Of the placer output $80,352 was won by dredges, an increase of $11,825 over 1930. Since 1897 gold worth $6,235,954 has been recovered by dredges. More than 52 per cent (9,635.08 ounces) of the total gold in 1931 was produced from mills using amalgamation; concentrates of all kinds yielded 13 per cent, crude ore shipped for smelting more than 4 per cent, and placers more than 28 per cent.

In 1931 three companies had a gold output of more than $53,000 each—the Talache Mines (Inc.) at Quartzburg, the Idaho Gold Dredging Co. at Warren, and the Idawa Gold Mining Co. at Placerville.

SILVER

The production of silver in Idaho in 1931 was 7,220,923 ounces, the smallest since 1922 and nearly 11 per cent less than the average annual output (8,080,427 ounces) for the decade 1922 to 1931. The output of silver in Shoshone County, which produced 97 per cent of the State's total, decreased 1,827,920 ounces, as a result of general curtailment in output of lead ore and lead-zinc ore at the large mines in the Coeur d'Alene region. Concentrates yielded nearly 93 per cent of the total silver, crude smelting ore more than 7 per cent, and placer bullion and gold and silver bullion from lode mines less than 0.1 per cent.

The largest producers of silver in Idaho in 1931, in order of output, were the Sunshine, Bunker Hill & Sullivan, Hecla, Morning, Crescent, and Page properties, all in Shoshone County.

COPPER

The production of copper in Idaho in 1931 was 1,144,915 pounds, a decrease from 3,111,555 pounds in 1930 and less than one-half the average yearly output (2,826,942 pounds) for the decade 1922 to 1931. The decrease was due to the low price of copper which automatically suspended operations at mines usually producing copper ore. Most of the copper produced in 1931 came from copper-lead ore, lead ore, and lead-zinc ore. Concentrates of all kinds yielded 91 per cent of the total copper; and crude smelting ore, 9 per cent.

The largest producers of copper in Idaho in 1931 were the Sunshine, Hecla, Bunker Hill & Sullivan, and Morning properties.

LEAD

The production of lead in Idaho in 1931 decreased 26 per cent in quantity from that in 1930 and was nearly 23 per cent less than the average annual output (257,008,124 pounds) for the decade 1922 to 1931. The unusually large decrease resulted from general curtailment in production of lead ore and lead-zinc ore at the large properties in Shoshone County, caused by the continued drop in metal prices. Shoshone County supplied more than 98 per cent of the total lead; most of the remainder came from two properties near Clark Fork, Bonner County. Concentrates of all kinds yielded 91 per cent of the total lead; and crude smelting ore, 9 per cent.

The Bunker Hill & Sullivan property at Kellogg was by far the largest producer of lead in Idaho in 1931; it was followed by the Hecla, Morning, Page, Jack Waite, Blackhawk, Golconda, and Sherman mines.

ZINC

The production of zinc in Idaho amounted to 39,137,212 pounds in 1931, a decrease of 48 per cent from 1930 and nearly 14 per cent less than the average annual output (45,312,349 pounds) for the decade 1922 to 1931. The decrease resulted from drastic curtailment by all producers of lead-zinc ore, caused by abnormally low metal prices. Some of the large mines, such as the Triumph near Hailey, the Constitution at Masonia, and the Star near Morning, suspended operations. Nearly 97 per cent of the total zinc came from mines in Shoshone County and nearly all the remainder from Valley County. All the zinc produced in 1931 came from concentrates, chiefly zinc concentrates from lead-zinc ore. The zinc products were treated at the electrolytic zinc plants at Anaconda and Great Falls, Mont., and Silver King, Idaho.

The Morning mine of the Federal Mining & Smelting Co. produced more than 60 per cent of the State's total zinc in 1931, although its output decreased 36 per cent from 1930; other large producers were the Bunker Hill & Sullivan, Frisco, Sidney, Golconda, Lost Pilgrim & Hall-Interstate, and Page properties.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1931, by counties, in terms of recovered metals

County	Gold					Silver (lode and placer)	
	Lode		Placer		Total value		
	Fine ounces	Value	Fine ounces	Value		Fine ounces	Value
Ada	18.53	$383	31.92	$660	$1,043	15	$4
Adams	2.71	56			56	183	53
Bear Lake						3	1
Benewah			1.02	21	21		
Bingham			10.06	208	208		
Blaine	28.59	591			591	10,258	2,975
Boise	8,899.98	183,979	1,092.12	22,576	206,555	9,488	2,752
Bonner						89,550	25,969
Bonneville			18.58	384	384		
Boundary						1,586	460
Butte	.10	2			2	36	10
Camas	154.80	3,200	10.45	216	3,416	72	21
Cassia			1.74	36	36		
Clark						63	18
Clearwater	16.98	351	79.33	1,640	1,991	100	29
Custer	12.19	252	52.29	1,081	1,333	4,831	1,401
Elmore	125.29	2,590	153.98	3,183	5,773	262	76
Gem			4.30	89	89		
Gooding			2.18	45	45		
Idaho	1,664.58	34,410	2,869.22	59,312	93,722	5,042	1,462
Jefferson			1.40	29	29		
Jerome			44.46	919	919	3	1
Latah			12.19	252	252	3	1
Lemhi	948.05	19,598	170.77	3,530	23,128	5,834	1,692
Nez Perce			5.37	111	111		
Owyhee	156.30	3,231	546.44	11,296	14,527	4,761	1,381
Power			4.35	90	90		
Shoshone	395.13	8,168	60.47	1,250	9,418	7,003,541	2,031,027
Twin Falls			29.61	612	612	3	1
Valley	721.32	14,911	11.27	233	15,144	85,289	24,734
Washington	3.29	68			68		
	13,147.84	271,790	5,213.52	107,773	379,563	7,220,923	2,094,068
Total, 1930	17,457.62	360,881	3,987.45	82,428	443,309	9,420,639	3,626,946

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Ada							$1,047
Adams	14,324	$1,303					1,412
Bear Lake			3,800	$141			142
Benewah							21
Bingham							208
Blaine	950	86	89,085	3,296	6,264	$238	7,186
Boise	1,935	176	30,182	1,117			210,600
Bonner	2,235	203	2,040,307	75,491			101,663
Bonneville							384
Boundary	339	31	85,161	3,151			3,642
Butte	1,165	106					118
Camas							3,437
Cassia							36
Clark			11,400	422			440
Clearwater	122	11	280	10			2,041
Custer	1,425	130	5,484	203			3,067
Elmore	605	55	1,942	72			5,976
Gem							89
Gooding							45
Idaho	996	91	77	3			95,278
Jefferson							29
Jerome							920
Latah							253
Lemhi	28,170	2,563	267,041	9,880			37,263
Nez Perce							111
Owyhee	53	5	725	27			15,940
Power							90
Shoshone	1,044,885	95,085	195,541,151	7,235,022	37,868,650	1,439,009	10,809,561
Twin Falls							613
Valley	47,711	4,342	652,593	24,146	1,262,298	47,967	116,333
Washington							68
	1,144,915	104,187	198,729,228	7,352,981	39,137,212	1,487,214	11,418,013
Total, 1930	3,111,555	404,502	268,115,963	13,405,798	75,298,172	3,614,312	21,494,867

Ore, old tailings, etc., sold or treated and lode mines producing in Idaho, 1930 and 1931, by counties

County	Ore, old tailings, etc.		Lode mines producing	
	1930	1931	1930	1931
	Short tons	*Short tons*		
Ada	1	40	1	1
Adams		23		1
Bear Lake		3		1
Blaine	25,949	410	10	6
Boise	25,480	21,272	13	17
Bonner	19,202	21,516	3	3
Boundary		89		1
Butte	8,437	5	5	2
Camas	75	129	3	4
Clark	22	25	1	1
Clearwater		24		2
Custer	27,671	15	7	3
Elmore	24	176	2	8
Idaho	8,293	2,435	14	23
Lemhi	8,420	2,496	16	17
Owyhee	354	252	12	10
Shoshone	1,794,929	1,239,592	38	30
Valley	25,679	11,422	3	5
Washington	364	3	3	1
	1,944,900	1,299,927	131	136

Gold and silver produced at placer mines in Idaho in 1931, by counties

County	Mines			Gold	Silver (fine ounces)	Total value
	Drift	Dredge	Hydraulic and sluicing			
Ada			4	$660	9	$662
Benewah			1	21		21
Bingham			3	208		208
Boise		2	21	22,576	369	22,683
Bonneville			2	384		384
Camas			2	216		216
Cassia			1	36		36
Clearwater			8	1,640	15	1,644
Custer			8	1,081	21	1,087
Elmore			23	3,183	39	3,194
Gem			1	89		89
Gooding			1	45		45
Idaho	1	1	33	59,312	906	59,575
Jefferson			1	29		29
Jerome			3	919	3	920
Latah			3	252	3	253
Lemhi			18	3,530	18	3,535
Nez Perce			1	111		111
Owyhee		1	3	11,296	450	11,427
Power			2	90		90
Shoshone	2		5	1,250	12	1,254
Twin Falls			5	612	3	613
Valley			4	233		233
	3	4	153	107,773	1,848	108,309
Total, 1930		3	58	82,428	1,355	82,950

MINING INDUSTRY

In general, the mining industry in Idaho in 1931 continued in the depressed condition of 1930. The total value of the metal output decreased nearly 47 per cent from that in 1930, due chiefly to curtailment in output of lead ore and lead-zinc ore at the large mines in Shoshone County. Only two of the larger mines—the Bunker Hill & Sullivan and the Sunshine—maintained normal production during the entire year. Other large producers, such as the Morning, Hecla, Star, Page, Blackhawk, Sidney, Galena, Frisco, Dayrock, Sherman, and Tamarack & Custer, reduced their output decidedly. No important new construction work was started during the year, and most of the companies reported only such development of ore bodies as was necessary in maintaining ore reserves.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Idaho in 1931, with content in terms of recovered metals

Source	Mines producing	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	78	[1] 24,210	11,060.20	13,575	2,503	5,718	
Dry gold and silver ore	1	[2] 152	18.02	905			
Dry silver ore	2	9	4.65	2,379		708	
Copper ore	6	548	439.07	1,421	41,588		
Lead ore	40	701,230	749.47	3,273,934	409,686	140,406,110	4,991,984
Copper-lead ore	4	195,643	2.82	2,671,907	437,642	1,426,943	
Lead-zinc ore	14	378,135	873.61	1,254,954	253,496	56,889,749	34,145,228
Total, lode mines	[3] 136	1,299,927	13,147.84	7,219,075	1,144,915	198,729,228	39,137,212
Total, placers	160		5,213.52	1,848			
	296	1,299,927	18,361.36	7,220,923	1,144,915	198,729,228	39,137,212
Total, 1930	192	1,944,900	21,445.07	9,420,639	3,111,555	268,115,963	75,298,172

[1] Includes 30 tons of old tailings and 1 ton of old mill cleanings treated by amalgamation and 83 tons of old mill cleanings sold to a smelter.

[2] Includes 125 tons of old tailings treated by cyanidation.

[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

Value of metals from ore, old tailings, etc., sold or treated in Idaho in 1931, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total value
Dry gold ore	24,210	$228,635	$3,937	$228	$211		$233,011
Dry gold and silver ore	152	373	262				635
Dry silver ore	9	96	690		26		812
Copper ore	548	9,076	412	3,785			13,273
Lead ore	701,230	15,493	949,441	37,281	5,195,026	$189,695	6,386,936
Copper-lead ore	195,643	58	774,853	39,825	52,797		867,533
Lead-zinc ore	378,135	18,059	363,937	23,068	2,104,921	1,297,519	3,807,504
	1,299,927	271,790	2,093,532	104,187	7,352,981	1,487,214	11,309,704
Total, 1930	1,944,900	360,881	3,626,424	404,502	13,405,798	3,614,312	21,411,917

GOLD ORE

The output of gold ore from 78 mines in Idaho in 1931 was 25 per cent less than that reported from 47 mines in 1930. The decrease was due chiefly to reduced output from the Sherman Howe property near Burgdorf, Idaho County. The Gold Hill & Iowa mine of the Talache Mines (Inc.) at Quartzburg was again the largest producer of gold ore followed by the Belshazzar mine of the Idawa Gold Mining Co. near Placerville, both in Boise County. The total gold ore, etc., yielded $9.44 in gold and 0.56 ounce of silver to the ton and a small quantity of copper and lead.

GOLD AND SILVER ORE

Nearly all the gold and silver material was old tailings from a property near Grand View, Owyhee County.

SILVER ORE

Nearly all (8 tons) of the output of silver ore in 1931 came from a property near Grand View, Owyhee County. The total silver ore produced yielded $10.67 in gold and 264.33 ounces of silver to the ton and a small quantity of lead.

COPPER ORE

The output of copper ore from 6 mines in Idaho in 1931 was 548 tons, compared with an output of 33,129 tons from 9 properties in 1930. Most of the output in 1931 came from 2 properties in Lemhi County. The large producers of copper ore in Idaho have been closed as a result of the low market price of copper. The average recovered content of the copper ore shipped or treated in 1931 was $16.56 in gold and 2.59 ounces of silver to the ton and 3.79 per cent copper.

LEAD ORE

Except in 1929, lead ore has been the most valuable mine product of Idaho from the time the Coeur d'Alene region became productive. Lead ore yielded metals valued at $6,386,936 in 1931 compared with $10,820,301 in 1930. The output of lead ore was 33 per cent less in 1931 than in 1930, as all but one of the larger producers of lead ore reduced their output decidedly. Nearly 94 per cent of the total was ore of concentrating grade from 10 producers in Shoshone County; 2 operators in Bonner County also mined considerable lead ore. The Bunker Hill & Sullivan property at Kellogg, Shoshone County, produced nearly 66 per cent of the total State output of lead ore; it was followed by the Hecla mine at Burke, also in Shoshone County, and the Whitedelf mine near Clark Fork, Bonner County. The Gold Hunter mine at Mullan, Shoshone County, a large producer of lead ore since 1922, and the old tailings dump of the Bunker Hill & Sullivan Mining & Concentrating Co. at Kellogg, a large producer of lead material in 1930, were both idle in 1931. The average recovered content of the lead ore in 1931 was 2 cents in gold and 4.67 ounces of silver to the ton, 0.03 per cent copper, 10.01 per cent lead, and 0.356 per cent zinc.

COPPER-LEAD ORE

Four mines reported the output of 195,643 tons of copper-lead ore in Idaho in 1931, compared with an output of 161,863 tons from three mines in 1930. Nearly all the copper-lead ore came from the Sunshine (Yankee Boy) and Crescent mines near Kellogg in Shoshone County. The increase of 24 per cent in the output of copper-lead ore from the Sunshine mine accounted for all the increase in the State total. Nearly all the copper-lead ore produced in 1931 was concentrated; the total output yielded 13.66 ounces of silver to the ton, 0.11 per cent copper, 0.36 per cent lead, and a little gold.

ZINC ORE

No zinc ore was produced in Idaho in 1931.

LEAD-ZINC ORE

In 1931 lead-zinc ore in Idaho continued to rank second in quantity after lead ore; the output from 14 mines, however, was 43 per cent less than that from 19 mines in 1930. The decrease was due to the continued drop in price of lead and zinc, which at the close of the year resulted in marked curtailment in the mining of lead-zinc ore. More than 97 per cent of the State's total output of lead-zinc ore came from 12 mines in Shoshone County; nearly all the remainder came from property in Valley County. The Morning mine in Shoshone County produced more than 61 per cent of the total, although its output decreased 36 per cent from 1930; other large producers of lead-zinc ore were the Page, Jack Waite, Frisco, Golconda, Blackhawk, and Sidney mines, all in Shoshone County, and the Lost Pilgrim & Hall-Interstate property in Valley County. Lead-zinc ore yielded 5 cents in gold and 3.32 ounces of silver to the ton, 0.034 per cent copper, 7.52 per cent lead, and 4.52 per cent zinc.

Ore, old tailings, etc., sold or treated in Idaho in 1931, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ada	40	18.53	6			
Blaine	3	5.85	9			
Boise	[1]20,772	8,853.61	8,336	1,654	5,191	
Camas	129	154.80	72			
Clearwater	24	16.98	85	122	280	
Custer	2	11.98	58			
Elmore	[2]162	106.29	111	193	42	
Idaho	[3]2,400	1,556.58	3,666	343	77	
Lemhi	[4]31	28.00	33	130		
Owyhee	[5]92	133.73	1,057	53	17	
Shoshone	[6]41	25.24	19	8	111	
Valley	511	145.32	123			
Washington	3	3.29				
	24,210	11,060.20	13,575	2,503	5,718	
Total, 1930	32,420	14,179.62	25,075	2,399	9,617	

COPPER ORE

Adams	23	2.71	183	14,324		
Butte	4		6	1,165		
Idaho	35	108.00	470	653		
Lemhi	486	328.36	762	25,446		
	548	439.07	1,421	41,588		
Total, 1930	33,129	810.36	26,262	1,379,869		

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[1] Includes 2 tons of old mill cleanings sold to a smelter.

[2] Includes 1 ton of old mill cleanings sold to a smelter.

[3] Includes 70 tons of old mill cleanings sold to a smelter.

[4] Includes 4 tons of old mill cleanings sold to a smelter.

[5] Includes 1 ton of old mill cleanings treated by amalgamation and 1 ton of old mill cleanings sold to a smelter.

[6] Includes 30 tons of old tailings treated by amalgamation and 5 tons of old mill cleanings sold to a smelter.

Ore, old tailings, etc., sold or treated in Idaho in 1931, by counties, with content in terms of recovered metals—Continued

LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Bear Lake	3		3		3, 800	
Blaine	107	16. 74	10, 243	950	77, 325	
Boise	500	46. 37	783	281	24, 991	
Bonner	21, 516		89, 550	2, 235	2, 040, 307	
Boundary	89		1, 586	339	85, 161	
Clark	25		63		11, 400	
Elmore	14	19. 00	112	412	1, 900	
Lemhi	1, 979	591. 69	5, 021	2, 594	267, 041	
Shoshone	676, 922	63. 93	3, 164, 255	402, 678	137, 893, 232	4, 991, 984
Valley	75	11. 74	2, 318	197	953	
	701, 230	749. 47	3, 273, 934	409, 686	140, 406, 110	4, 991, 984
Total, 1930	1, 051, 962	1, 073. 79	4, 462, 368	736, 994	173, 263, 711	6, 689, 544

LEAD-ZINC ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Blaine	300	6. 00	6		11, 760	6, 264
Shoshone	366, 999	303. 35	1, 172, 100	205, 982	56, 226, 349	32, 876, 666
Valley	10, 836	564. 26	82, 848	47, 514	651, 640	1, 262, 298
	378, 135	873. 61	1, 254, 954	253, 496	56, 889, 749	34, 145, 228
Total, 1930	663, 880	1, 330. 69	2, 258, 124	499, 255	93, 109, 758	68, 508, 360

Zinc products (as marketed from Idaho mines and mills) sold to smelters or electrolytic plants in 1931

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of concentrates	Recovered zinc
		Short tons	*Pounds*	*Per cent*	*Pounds*
Zinc concentrates	Blaine, Shoshone, and Valley	38, 450	42, 329, 753	55. 05	38, 884, 390
Lead-zinc concentrates	Shoshone	355	295, 223	41. 58	252, 822
		38, 805	42, 624, 976	54. 92	39, 137, 212
Total, 1930		77, 102	81, 932, 211	53. 13	75, 298, 172

METALLURGIC INDUSTRY

The year 1931 was one of retrenchment for the metallurgic industry in Idaho. No large milling plants were built, and no additions were made to existing plants. Several large milling plants were idle during the year, and many others were operated far below their rated capacities. The West or main mill of the Bunker Hill & Sullivan Mining & Concentrating Co. and the mill of the Sunshine Mining Co. were the only plants in Idaho that operated at normal capacity.

The Bunker Hill smelter operated at slightly less than normal capacity, and the electrolytic zinc and cadmium plants of the Sullivan Mining Co. were operated at much less than normal rate.

New construction work of interest included a 100-ton mill at the Hope mine in Bonner County, a pilot mill for gold-antimony ore at Yellow Pine, Valley County, and a 200-ton mill for gold-silver ore at Atlanta, Elmore County. A new dredge was erected and operated at Warren, Idaho County.

In Idaho 48 milling plants of all kinds were active in 1931 compared with 46 plants in 1930. Of these mills 28 were concentration plants, of which 6 used flotation machines with gravity concentration devices, 19 used flotation alone, and 3 used jigs and tables without flotation cells; 14 used amalgamation alone; 3 used amalgamation with concentration tables; 2 used amalgamation with flotation cells; and 1 used cyanidation. Besides the milling plants, 1 electrolytic leaching plant treated zinc concentrates.

In 1931 nearly 2 per cent of the total ore, old tailings, etc. (23,759 tons of ore and 31 tons of old tailings, etc.) was treated by amalgamation; a small quantity of crude ore and old tailings was treated by cyanidation. The gold and silver recovered by both processes were valued at $200,465, or $8.37 per ton of material treated. Nearly 61 per cent of the total ore treated by amalgamation was gold ore from the Gold Hill & Iowa property of the Talache Mines (Inc.) at Quartzburg, Boise County.

Mine production of metals from gold and silver mills in Idaho in 1931, by counties, in terms of recovered metals

County	Ore, old tailings, etc., treated (dry weight)		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings, etc.	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Ada	40		18.53	6		
Boise	20,604		8,080.48	1,427		
Camas	121		110.90	49		
Clearwater	1		1.98			
Custer	1		2.43	15		
Elmore	139		17.78	10		
Idaho	2,310		1,201.09	545		
Lemhi	16		11.35	4		
Owyhee	40	126	39.26	79	18.02	905
Shoshone		30	2.67	1		
Valley	511		145.32	123		
Washington	3		3.29			
	23,786	156	9,635.08	2,259	18.02	905
Total, 1930	31,915	128	12,615.21	3,561	2.45	236

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Boise	208	506.80	4,269	1,379	2,627
Camas	7	22.78	14		
Idaho	18	65.69	2,460	60	77
Lemhi	4	5.36	11	50	
	237	600.63	6,754	1,489	2,704
Total, 1930	329	853.90	12,040	668	3,242

Of the total ore, old tailings, etc., 1,255,008 tons (96.54 per cent) were ore concentrated. More than 54 per cent of the total ore concentrated was lead ore; nearly all the remainder was lead-zinc ore and copper-lead ore. For 1931 exact figures were again obtained giving the gross content of the mill feed. The results are presented in the accompanying tables, where they are separated by classes of ore, methods of concentration, and classes of concentrates produced.

Idaho ore[1] concentrated in 1931, by classes of ore, methods of concentration, and classes of concentrates

Class of ore concentrated	Method of concentration	Ore concentrated	Gross content of mill feed				
			Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Copper sulphide	Flotation	285	121.00	600	13,700		
Copper-lead sulphide	do	195,392	5.00	2,748,888	645,835	1,539,690	
Lead sulphide	do	39,753	15.00	219,638	56,348	6,320,149	30,092
Lead-zinc sulphide	do	378,135	1,132.66	1,342,638	388,435	64,416,615	46,900,875
		613,565	1,273.66	4,311,764	1,104,318	72,276,454	46,930,967
Siliceous gold	Gravity and flotation	70	50.00	660			
Lead sulphide	do	641,288	709.45	2,731,793	524,195	128,064,417	17,487,098
		641,358	759.45	2,732,453	524,195	128,064,417	17,487,098
Siliceous gold	Gravity	39	17.70	18			
Copper sulphide	do	40	100.00	80	900		
Lead sulphide	do	6	1.20	240		4,000	
		85	118.90	338	900	4,000	
		[2]1,255,008	2,152.01	7,044,555	1,629,413	200,344,871	64,418,065

Class of ore concentrated	Method of concentration	Concentrates produced		Gross content of concentrates				
		Class	Quantity	Gold	Silver	Copper	Lead	Zinc
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Copper sulphide	Flotation	Copper sulphide	23	108.36	470	11,686		
Copper-lead sulphide	do	Copper-lead sulphide	4,790	2.12	2,636,994	606,040	1,453,749	
Lead sulphide	do	Lead sulphide	4,537	11.29	198,482	35,701	5,703,623	
		Lead-zinc sulphide	27		500		11,500	22,161
			4,564	11.29	198,982	35,701	5,715,123	22,161
Lead-zinc sulphide	do	Lead sulphide	40,111	533.68	1,109,225	182,024	57,853,317	
		Lead-zinc sulphide	328		5,754	1,342	152,717	273,062
		Zinc sulphide	33,334	339.93	139,975	139,055	1,863,346	36,929,049
			73,773	873.61	1,254,954	322,421	59,869,380	37,202,111
			83,150	995.38	4,091,400	975,848	67,038,252	37,224,272
Siliceous gold	Gravity and flotation	Siliceous gold	1	45.36	563			
Lead sulphide	do	Lead sulphide	116,381	613.51	2,571,166	429,384	121,197,046	
		Zinc sulphide	5,116	36.00	26,246	21,445	362,537	5,400,704
			121,497	649.51	2,597,412	450,829	121,559,583	5,400,704
			121,498	694.87	2,597,975	450,829	121,559,583	5,400,704
Siliceous gold	Gravity	Siliceous gold	5	14.96	13			
Copper sulphide	do	Copper sulphide	10	84.00	54	705		
Lead sulphide	do	Lead sulphide	3	.85	190		3,189	
			18	99.81	257	705	3,189	
			[3]204,666	1,790.06	6,689,632	1,427,382	188,601,024	42,624,976

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[1] No old tailings reconcentrated in Idaho in 1931.

[2] Figures do not include 7,781 tons of siliceous ore treated by amalgamation and concentration.

[3] Figures do not include 237 tons of siliceous concentrates from ore first treated by amalgamation, containing 600.63 ounces of gold, 6,754 ounces of silver, 1,945 pounds (1,489 pounds recovered) of copper, and 2,816 pounds (2,704 pounds recovered) of lead.

Metals recovered from concentrates—from ore concentrated and from part of the ore treated in gold and silver mills—were valued at $50.03 per ton of concentrates compared with $66.02 in 1930. The concentrates came largely from the Coeur d'Alene region (Shoshone County) where operators shipped an average of 18,408 tons of concentrates and crude ore of various kinds a month compared with 25,250 tons in 1930. The average value of metals recovered from lead concentrates decreased from $67.22 to the ton of concentrates in 1930 to $48.04 in 1931, that from zinc concentrates from $52.68 to $42.18, and that from copper-lead concentrates from $246.60 to $178.50. The copper-lead concentrates were valuable chiefly for their silver content. The total value of metals recovered from lead concentrates represented more than 75 per cent of that from all concentrates.

Mine production of metals from concentrating mills in Idaho in 1931, by counties, in terms of recovered metals

County	Ore and old tailings treated		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	309		34	12.70	205		14,821	6,264
Boise	530		59	54.14	787	281	24,991	
Bonner	21,357		1,380		84,943	2,127	1,850,198	
Idaho	35		5	108.00	470	653		
Lemhi	1,796		62	646.63	600	12,311	28,346	
Owyhee	70		1	45.36	563			
Shoshone	1,220,005		201,339	352.76	6,518,406	980,638	177,881,913	37,868,650
Valley	10,906		1,786	570.47	83,658	47,582	651,978	1,262,298
	1,255,008		204,666	1,790.06	6,689,632	1,043,592	180,452,247	39,137,212
Total, 1930	1,771,688	115,194	300,357	3,207.37	8,790,733	2,849,161	247,869,785	75,298,172

Gross metal content of Idaho concentrates produced in 1931, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	243	660.95	7,330	1,945	2,816	
Copper	33	192.36	524	12,391		
Lead	161,032	1,159.33	3,879,063	647,109	184,757,175	
Zinc	38,450	375.93	166,221	160,500	2,225,883	42,329,753
Copper-lead	4,790	2.12	2,636,994	606,040	1,453,749	
Lead-zinc	355		6,254	1,342	164,217	295,223
	204,903	2,390.69	6,696,386	1,429,327	188,603,840	42,624,976
Total, 1930	300,686	4,061.27	8,802,773	3,340,538	257,702,599	81,932,211

Mine production of metals from Idaho concentrates in 1931, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	34	12.70	205		14,821	6,264
Boise	267	560.94	5,056	1,660	27,618	
Bonner	1,380		84,943	2,127	1,850,198	
Camas	7	22.78	14			
Idaho	23	173.69	2,930	713	77	
Lemhi	66	651.99	611	12,361	28,346	
Owyhee	1	45.36	563			
Shoshone	201,339	352.76	6,518,406	980,638	177,881,913	37,868,650
Valley	1,786	570.47	83,658	47,582	651,978	1,262,298
	204,903	2,390.69	6,696,386	1,045,081	180,454,951	39,137,212
Total, 1930	300,686	4,061.27	8,802,773	2,849,829	247,873,027	75,298,172

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	243	660.95	7,330	1,489	2,704	
Copper	33	192.36	524	12,075		
Lead	161,032	1,159.33	3,879,063	477,381	176,834,481	
Zinc	38,450	375.93	166,221	128,633	2,063,879	38,884,390
Copper-lead	4,790	2.12	2,636,994	424,228	1,395,599	
Lead-zinc	355		6,254	1,275	158,288	252,822

Of the total ore, etc., 1.61 per cent was shipped crude, chiefly to the smelter at Bradley, Idaho. The total value of metals recovered from first-class ore was $852,168 compared with $1,298,163 in 1930. Of the crude ore shipped to smelters 96.6 per cent was lead ore, mainly from the Hecla mine at Burke, Shoshone County. More than 96 per cent of the total ore smelted was sulphide.

Gross metal content of Idaho crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Quantity (dry weight)	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous	237	459.28	5,860	1,166	4,009
Copper	223	246.71	897	30,381	
Lead	20,183	87.82	477,350	79,279	19,011,734
Copper-lead	251	.70	34,913	17,435	32,218
	20,894	794.51	519,020	128,261	19,047,961
Total, 1930	25,975	778.69	612,714	291,081	21,045,257

Mine production of metals from Idaho crude ore shipped to smelters in 1931, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Adams	23	2.71	183	14,324	
Bear Lake	3		3		3,800
Blaine	101	15.89	10,053	950	74,264
Boise	136	225.56	2,610	275	2,564
Bonner	159		4,607	108	190,109
Boundary	89		1,586	339	85,161
Butte	5	.10	36	1,165	
Camas	8	21.12	9		
Clark	25		63		11,400
Clearwater	23	15.00	85	122	280
Custer	14	9.76	4,795	1,425	5,484
Elmore	36	36.53	174	605	1,900
Idaho	20	119.75	320	283	
Lemhi	680	280.14	5,198	15,769	238,695
Owyhee	15	34.66	2,678	53	725
Shoshone	19,552	27.76	485,112	64,247	17,659,238
Valley	5	5.53	1,508	129	615
	20,894	794.51	519,020	99,794	18,274,235
Total, 1930	25,975	778.69	612,714	261,726	20,242,936

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead
Dry and siliceous	237	459.28	5,860	974	3,680
Copper	223	246.71	897	29,513	
Lead	20,183	87.82	477,350	55,893	18,239,211
Copper-lead	251	.70	34,913	13,414	31,344

The combined value of metals from concentrates and crude shipping ore was $11,102,689 compared with $21,149,625 in 1930.

No miscellaneous material other than old tailings amalgamated and cyanided and 83 tons of clean-up material smelted was reported for 1931, and no ore was treated locally by either leaching or roasting methods.

REVIEW BY COUNTIES AND DISTRICTS

Notes usually given under the district reviews in this series of reports have been greatly curtailed in an effort to reduce the size of the chapters for 1931. Details on development, notes from printed reports, and statements comparing the production of the current year with that of past years have been omitted unless of unusual importance. Mention of the production of small quantities of placer gold or small shipments of ore in certain districts has also been omitted.

ADA COUNTY

Black Hornet district.—A little gold ore from the McCarty group was treated by amalgamation, and bullion valued at $385 was deposited at the Boise assay office.

Boise River district.—Placer gold valued at $120 was recovered from a prospect on the Boise River west of Boise.

Highland district.—Placer bullion valued at $542 was marketed from three placers (chiefly from the Smuggler claim) on the Boise River east of Barber.

ADAMS COUNTY

Seven Devils district.—One car of copper ore from the Blue Jacket mine near Cuprum was shipped to a smelter.

BEAR LAKE COUNTY

St. Charles district.—A test lot of sulphide lead ore from a prospect near Ovid was shipped to Murray, Utah, for smelting.

BENEWAH COUNTY

St. Joe district.—Placer gold valued at $21 was produced from the banks of St. Maries River near St. Joe.

BINGHAM COUNTY

Snake River district.—Placer operators on the Snake River near Blackfoot produced gold valued at $208.

BLAINE COUNTY

The value of the production of metals in Blaine County decreased from $559,406 in 1930 to $7,186 in 1931 as the result of inactivity at the Triumph mine near Hailey. From 1880 to 1931 Blaine County has produced $2,576,747 in gold, $16,678,992 in silver, $72,521 in copper, $9,606,162 in lead, and $1,616,579 in zinc, a total of $30,551,001. The quantities of the various metals follow: Gold, 124,651.88 fine ounces; silver, 18,566,579 fine ounces; copper, 427,864 pounds; lead, 211,439,279 pounds; and zinc, 24,700,251 pounds.

Mineral Hill district (*Hailey*).—Three lode mines in the Mineral Hill district produced 309 tons of ore yielding $263 in gold, 205 ounces of silver, 14,821 pounds of lead, and 6,264 pounds of zinc, valued in all at $1,109, or $3.59 in metals a ton. Nearly all the output was lead-zinc ore from the property of the Liberty Gem Mines (Inc.) treated in a new 100-ton flotation plant. A little lead ore from the Nay Aug group was treated in a small hand jig, and a test lot of gold ore from the Croesus mine was treated by concentration.

Warm Springs district (*Ketchum*).—Three lode mines in the Warm Springs district produced 101 tons of ore yielding $328 in gold, 10,053 ounces of silver, 950 pounds of copper, and 74,264 pounds of lead, valued in all at $6,077, a notable decrease from a district output of $558,132 in 1930. The large decrease resulted from idleness at the Triumph property near Hailey. Nearly all the output in 1931 was first-class lead-silver ore from the Independence mine of the Federal Mining & Smelting Co., operated by lessees.

BOISE COUNTY

The value of the production of metals in Boise County decreased from $288,874 in 1930 to $210,600 in 1931 as the result of suspension of operations at the Gold Hill & Iowa mine of the Talache Mines (Inc.) caused by a forest fire in August, the burning in July of the dredge of the Idaho Gold Dredging Corporation, and decreased output of gold ore from the property of the Idawa Gold Mining Co. The placer production was valued at $22,683, a decrease from $57,787 in 1930.

Banner district.—The Crooked River Mining Co. operated its dredge northeast of Idaho City only 12 days in 1931, and as a result the value of the bullion produced decreased from about $5,500 in 1930 to about $2,000 in 1931.

Boise Basin district (Centerville, Placerville, Idaho City, Pioneerville).—Seventeen placers and 13 lode mines in the Boise Basin district produced 21,220 tons of ore, $203,534 in gold, 9,330 ounces of silver, 1,935 pounds of copper, and 30,182 pounds of lead, valued in all at $207,532. The ore had an average value of $8.83 in metals a ton. The placer output consisted of $20,049 in gold and 298 ounces of silver, valued together at $20,135.

The Gold Hill & Iowa mine, again the largest producer of gold in Idaho, was operated by the Talache Mines (Inc.) from January 1 to August 20 when a forest fire destroyed the entire mining and milling plant. The company treated 14,450 tons of ore by amalgamation and marketed bullion (containing 5,726.31 ounces of gold and 712 ounces of silver) valued at $117,511 in 1931 compared with $118,508 in 1930.

The Idawa Gold Mining Co. continued to operate the Belshazzar mine, but the output of gold was 27 per cent less than in 1930. The ore was treated by amalgamation and concentration. The Mountain Chief property was operated under lease by the Ideal Mining Co., and 1,100 tons of gold ore were treated in a 40-ton amalgamation and concentration plant. Gold bullion and concentrates valued at $3,843 were marketed. Other producers of gold ore were the Come-Back, K. C. group, Electrum, Mammoth, Hay Fork & Black Eagle, and Mascot properties. The Smuggler, Big Enterprise, and Blackbird group was operated by lessees who treated several hundred tons of lead ore in a mill equipped with tables and flotation cells. Lead concentrates containing nearly an ounce of gold to the ton were shipped to Utah for smelting.

Most of the placer output came from dredging operations on Grimes Creek by the Idaho Gold Dredging Corporation. The dredge was destroyed by fire July 13, and the value of the bullion produced decreased from about $50,000 in 1930 to about $13,000 in 1931. Other placers that produced more than $400 each were the Alandoc, Franklin (California Hill), Apple Jack, and Gold Hill.

Boise River (Twin Springs) district.—Placer bullion valued at $383 was recovered from claims on the Boise River, chiefly from the Diggers placer near Twin Springs.

Miller Creek district.—A little gold bullion was produced from the Baby Girl placer near Lowman.

Payette River district.—Placer gold valued at $33 was marketed from the Jackson Bar property near Horseshoe Bend.

Shafer district.—The Continental Mining Co. shipped a test lot of gold ore from the Long Chance property near Horseshoe Bend.

West View district.—One car of gold ore from the East Star group and a test lot of gold ore from the Osborne mine were shipped to plants in Utah for smelting.

BONNER COUNTY

The value of the production of metals in Bonner County decreased from $129,148 in 1930 to $101,663 in 1931, due chiefly to the decline in market price of silver and lead, as the output of both silver and lead was more than in 1930.

Pend d'Oreille district.—Three lode mines in the Pend d'Oreille district produced 21,516 tons of ore yielding 89,550 ounces of silver, 2,235 pounds of copper, and 2,040,307 pounds of lead, valued in all at $101,663, or $4.72 in metals a ton. The Whitedelf Mining Co. was again the largest producer in the district, but its output of both lead and silver was less than in 1930. The company treated more than 15,000 tons of lead ore by flotation and shipped 926 tons of lead concentrates to East Helena, Mont., for smelting. The Hope Mining Co. treated about 6,000 tons of lead ore in its new 100-ton flotation plant and shipped 454 tons of lead concentrates and 65 tons of first-class lead ore to East Helena, Mont. The remainder of the district output was 71 tons of high-grade lead ore from the Lawrence property.

BONNEVILLE COUNTY

Mt. Pisgah district.—Exceptionally fine gold valued at $333 was marketed from the American Bar placer.

Snake River district.—A little placer gold was marketed from a prospect on the Snake River near Idaho Falls.

BOUNDARY COUNTY

Port Hill district.—The Continental mine of the Idaho Continental Co. at Port Hill was operated by lessees who shipped 89 tons of lead ore to the smelter at Bradley.

BUTTE COUNTY

The production of metals in Butte County was valued at $118 in 1931, a decided decrease from $91,677 in 1930, due entirely to idleness of the Wilbert mine near Howe.

Hamilton district.—A test lot of copper ore from the Copper Bell prospect, 39 miles northwest of Howe, was shipped to Garfield, Utah, for smelting.

CAMAS COUNTY

Little Smoky district.—Placer gold valued at about $180 was marketed from the Axolotl property on Bear Creek.

Skeleton Creek district.—Four lode mines in the Skeleton Creek district produced 129 tons of ore yielding $3,200 in gold and 72 ounces of silver, valued together at $3,221. Most of the output was gold ore from the El Oro mine near Fairfield, treated by amalgamation and concentration; bullion, concentrates, and a little first-class smelting ore, yielding gold and silver valued at nearly $2,000, were marketed. The remainder of the district output was chiefly gold ore from the Grubstake-Snowslide-Remington group treated in a small amalgamation mill.

CASSIA COUNTY

Snake River district.—Placer gold valued at $36 was marketed from the Brim claim near Burley.

CLARK COUNTY

Birch Creek district.—One car of oxidized lead ore from a mine near Winsper was shipped to Murray, Utah, for smelting.

CLEARWATER COUNTY

Burnt Creek district.—Placer gold valued at about $70 was marketed from the Sunshine property on Burnt Creek.

Moose Creek district.—Placer bullion valued at $668 was marketed from the Dodo Amended, Last Chance, and Wallace claims on Independence and Moose Creeks.

Pierce district.—Placer bullion valued at $904, recovered from several claims near Pierce, was sold to a local merchant.

Ruby Creek district.—A test lot of gold ore from the Brady property near Elk River was shipped to Tacoma, Wash., for smelting.

CUSTER COUNTY

The value of the production of metals in Custer County decreased from $204,318 in 1930 to $3,067 in 1931, due chiefly to the closing of the copper property of the Mackay Metals (Inc.) in July, 1930.

Bay Horse district.—Lessees operating the Ramshorn mine shipped 1 car of copper-lead ore containing 365 ounces of silver to the ton; a small lot of rich gold ore was produced from a prospect near Challis.

Stanley Basin district.—Six placers in the Stanley Basin district produced $917 in gold and 18 ounces of silver, valued together at $922. The chief producers were the Jose Gulch, Clay Flat, and W. K. Lynch properties.

Yankee Fork district.—Most of the output from the Yankee Fork district was placer gold valued at about $136 from the Rough Creek property. A test lot of gold ore from a lode mine was treated by amalgamation.

ELMORE COUNTY

The value of the production of metals in Elmore County increased from $1,129 in 1930 to $5,976 in 1931, due to the increased output of gold from both lode and placer mines.

Bear Creek district.—Most of the output from the Bear Creek district was placer bullion valued at $1,008, chiefly from the property of the Feather River Gold Placer Co. and the Tempest-Golden Chariot-Alice C'Ceal group. A little gold ore from the Chieftain and Nugget lode mines at Rocky Bar was treated by amalgamation.

Black Warrior district.—Placer bullion valued at $100 was produced by sluicing at the Red Stump property.

Charcoal Creek district.—Gold valued at $122 was recovered from placer operations on Charcoal Creek.

Middle Boise district (Atlanta).—Four placers and three lode mines in the Middle Boise district produced 161 tons of ore, $1,232 in gold, 184 ounces of silver, 605 pounds of copper, and 1,900 pounds of lead, valued in all at $1,411. The placer bullion, valued at $363, came chiefly from the Baker & Gardner claims near Atlanta. Most of the ore was siliceous gold ore from the Winner group, treated by amalgamation, and first-class lead ore and gold ore from a mine near Atlanta.

Neal district.—A test lot of first-class gold ore from the Sunset mine was shipped to a smelter in Utah.

Pine Grove district.—Clean-up material containing about $1,400 in gold was shipped from the old Franklin mill to Midvale, Utah, for smelting.

Snake River district.—Seven placers on the Snake River near Hammett and King Hill produced $1,036 in gold and 3 ounces of silver, valued together at $1,037. The chief producers were the Baker, Wilson, and Dollar claims.

Twin Springs district.—Five placers in the Twin Springs district produced $562 in gold and 9 ounces of silver, valued together at $564. The output came from various claims on the Boise River near Twin Springs.

GEM COUNTY

West View district (Emmett, Eagle).—Gold valued at $89 was marketed from the Smith Creek placers.

GOODING COUNTY

Snake River district.—Placer gold valued at $45 was recovered from a property on the Snake River near Hagerman.

IDAHO COUNTY

The production of metals in Idaho County was valued at $95,278 in 1931; the increase of $13,232 over 1930 was due to the large quantity of gold produced at the new dredge of the Idaho Gold Dredging Co. at Warren. The Sherman Howe Mining Co., the largest producer in the county in 1930, reported a decided decrease in gold output in 1931.

Camp Howard district.—Ten placers in the Camp Howard district produced $975 in gold and 9 ounces of silver, valued together at $978. The entire output came from various small operations on the Salmon River near White Bird.

Dewey (*Harpster*) *district* (*Grangeville*).—Two placers in the Dewey district produced $381 in gold and 3 ounces of silver, valued together at $382. Nearly all the output came from the Blue Bird claim near Harpster.

Dixie district.—One placer and three lode mines in the Dixie district produced 8 tons of ore, $1,153 in gold, and 24 ounces of silver, valued together at $1,160. Most of the output was rich gold ore of smelting grade from the Surprise mine near Dixie. A little gold ore was also produced from the Gold Leaf and Ajax mines. The placer output, valued at $33, came from the Capital property near Dixie.

Elk City district.—Six placers and two lode mines in the Elk City district produced 7 tons of ore, $810 in gold, and 12 ounces of silver, valued together at $813. The placer output, valued at $662, came from various small placer operations near Elk City. The output from lode mines was siliceous gold ore, chiefly from the Lark property near Elk City.

Marshall Lake district (*Burgdorf*).—The Sherman Howe Mining Co. continued to develop its Walker-Wilcox property near Burgdorf, but the quantity of gold ore treated by amalgamation and flotation was only about one-fifth that in 1930. A little gold ore from the Leadville mine was treated by amalgamation.

Newsome district.—The Hay Fork placer near Golden was operated about five months, and bullion valued at more than $500 was marketed.

Orogrande district.—A little gold ore from the Biglow mine was treated by amalgamation. Gold bullion valued at more than $3,400 was cleaned up from an old mill.

Robbins district.—Four lode mines in the Robbins district produced 57 tons of ore yielding $3,891 in gold, 777 ounces of silver, and 936 pounds of copper, valued in all at $4,201, or $73.70 in metals a ton. Most of the district output was copper ore, exceptionally rich in gold, from the War Eagle mine operated by the Central Idaho Mining & Milling Co. The larger part of the company ore was treated in a small flotation plant; the concentrates and a little first-class smelting ore were shipped to Tacoma, Wash. The remainder of the district output was small lots of gold ore from prospects near Grangeville.

Salmon River district.—Two placers on the Salmon River near its junction with the Snake River produced bullion valued at $281.

Simpson district.—Five placers in the Simpson district produced $602 in gold and 3 ounces of silver, valued together at $603. The output came from various small operations on the Salmon River between Lucile and Riggins.

Ten Mile district (*Golden*).—Seven lode mines in the Ten Mile district produced 989 tons of ore yielding $15,149 in gold and 312 ounces of silver, valued together at $15,239. The Lone Pine mine was, as usual, the largest producer in the district; 578 tons of gold ore were treated by amalgamation, and bullion valued at nearly $9,500 was marketed. The New York mine was operated a short time by the Central Idaho Gold Mines (Inc.), and a few hundred tons of gold ore were treated by amalgamation and flotation concentration. The remainder of the district output was gold ore, chiefly from the Mackey and Gilt Edge properties, treated by amalgamation.

Warren district.—Five placers and two lode mines in the Warren district produced 30 tons of ore, $56,013 in gold, and 885 ounces of silver, valued together at $56,269. The ore averaged $11.77 in metals a ton. The placer output, valued at $55,916, came chiefly from operation of the new dredge of the Idaho Gold Dredging Co. The dredge has a daily capacity of 2,500 cubic yards and started operating September 11, 1931. The property became the second largest producer of gold in Idaho in 1931, and its output of gold prevented a much larger decrease in the total output of the State. Other producing placers were the Golden Rule, Laughing Water, Idaho, and Shissler Creek. The output from lode mines was siliceous gold ore from the Lucky Ben and Delaware properties, treated by amalgamation.

JEROME COUNTY

Snake River district.—Placer bullion valued at $920 was recovered from operations at three properties on the Snake River near Jerome.

LATAH COUNTY

Hoodoo district (*Harvard*).—Placer gold valued at nearly $200 was recovered by hand sluicing at the Rex property near Harvard.

LEMHI COUNTY

The value of metals produced in Lemhi County was $37,263 in 1931; the decrease of $26,325 from 1930 resulted from inactivity at the copper mines near Salmon.

Eldorado district (*Salmon*).—Five lode mines in the Eldorado district produced 491 tons of ore yielding $6,873 in gold, 777 ounces of silver, and 25,486 pounds of copper, valued in all at $9,417, or $19.18 in metals a ton. About half of the output was gold-bearing copper ore from the Ranger mine operated by the Eldorado Gold Mining Co. The remainder of the district output consisted of 1 car of copper concentrates from former milling operations of the Harmony Mines Co., a small quantity of first-class copper ore from the Gold Point mine, and small lots of gold ore from the Gold Bug and Old Homestake mines.

Eureka district.—Five placers in the Eureka district produced $610 in gold and 6 ounces of silver, valued together at $612. The decline in district output from $28,623 in 1930 resulted from idleness at the copper property (Pope-Shenon mine) of the Winder-Stillman Con. The chief placer producers in 1931 were the Specie Payment, McNutt, and Standard claims.

Gibbonsville district.—The total value of the metal output of the Gibbonsville district was $410. Most of the output was gold material cleaned up from the old mills at the Big Four and Hope properties. A little gold ore from the Lick Creek (Golden Reward) mine was treated by amalgamation and concentration. Placer gold valued at $99 was recovered, chiefly from the Last Chance property.

McDevitt district (Tendoy).—A little gold ore from the Copper Queen (Tendoy Copper Queen Mining Co.) property was treated in a small concentration mill; the concentrates and a test lot of crude ore were shipped to a smelter in Utah.

Mackinaw district (Leesburg).—Nine placers and one lode mine in the Mackinaw district produced 17 tons of ore, $3,107 in gold, 202 ounces of silver, and 5,805 pounds of lead, valued in all at $3,380. The placer output, valued at $2,732, came chiefly from the Hockensmith and Richardson properties. The Bluejay mine, 6 miles south of Leesburg, was the only producing lode mine in the district in 1931.

Nicholia district.—Lessees operating the Viola mine 21 miles southeast of Gilmore shipped 107 tons of first-class oxidized lead ore to smelting plants in Utah.

Pratt Creek district.—The Goldstone Mines Corporation continued operations at its property on Pratt Creek and treated 1,500 tons of lead ore in the 100-ton table and flotation concentration plant. About 31 tons of lead concentrates containing 18.09 ounces of gold to the ton were shipped to Midvale, Utah, for smelting.

Texas district (Gilmore).—Four lode mines in the Texas district produced 355 tons of ore yielding $258 in gold, 3,750 ounces of silver, 1,670 pounds of copper, and 174,236 pounds of lead, valued in all at $7,944, or $22.38 in metals a ton. The output was all first-class oxidized lead ore of smelting grade from the Allie, Latest Out, and Pittsburg-Idaho properties and a prospect near Gilmore.

NEZ PERCE COUNTY

Placer gold valued at $111 was marketed from a property on the Snake River south of Lewiston.

OWYHEE COUNTY

The production of metals in Owyhee County was valued at $15,940 in 1931, a decrease of $5,302 from 1930. From 1863 to 1931 the county yielded $21,774,398 in gold and 24,633,344 ounces of silver, or a value of $40,767,151 for both metals. Since 1928 the greater part of the output has been placer gold from the dredge of the American Gold Dredging Corporation near Triangle.

Carson or French district (*Silver City*).—The total value of the metal output of the Carson district in 1931 was $3,503. Most of the output was gold ore from the Never Sweat mine, treated by gravity and flotation concentration; other producers of gold ore were the Gold Bug, Mountain Chief, and Village Blacksmith mines. A small quantity of old mill clean-up material containing considerable gold was shipped to the smelter at Garfield, Utah. Bullion valued at $427 was recovered from the Jordan Creek Placers near De Lamar.

Castle Creek district.—The Pick & Shovel property 15 miles west of Grand View was operated a short time, and 125 tons of old tailings and 27 tons of crude ore (siliceous gold and silver) were treated by cyanidation; bullion valued at $631 was deposited at the Boise assay office. A small lot of crude ore averaging nearly 300 ounces of silver to the ton was shipped from the Little Amie property to a smelter in Utah.

Snake River district.—Placer bullion valued at $377 was marketed from claims on the Snake River, chiefly from the September Morn (Davis) placer 10 miles south of Melba.

Steele district.—The electrically driven dredge (daily capacity, 1,500 cubic yards) of the American Gold Dredging Corporation near Triangle was operated only 3 months in 1931 as the water supply was short. Bullion valued at about $10,600 was sent to Boise.

POWER COUNTY

Snake River district.—Two operators on the Snake River near American Falls marketed placer gold valued at $90.

SHOSHONE COUNTY

COEUR D'ALENE REGION

Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, Idaho, 1930 and 1931, and total, 1884–1931, in terms of recovered metals

Year	Lode mines	Placers	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc	Total value
			Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1930	38	4	[1] 1,794,929	[2] $11,648	[2] 8,831,461	1,569,882	258,621,960	66,290,478	$19,728,887
1931	30	7	[1] 1,239,592	[2] 9,418	[2] 7,003,541	1,044,885	195,541,151	37,868,650	10,809,561
Total, 1884–1931	------	------	(3)	7,180,151	262,277,378	82,676,978	[4] 4,306,687	853,130,752	731,374,415

[1] Includes old tailings, etc., as follows: 1930, 115,194 tons of old tailings concentrated; 1931, 30 tons of old tailings amalgamated and 5 tons of old mill cleanings sold to a smelter.

[2] Includes placer production as follows: 1930, $1,425 in gold and 10 ounces of silver; 1931, $1,250 in gold and 12 ounces of silver.

[3] Figures not available.

[4] Short tons.

The value of the production of metals in Shoshone County, which includes the Coeur d'Alene region, was $10,809,561 in 1931—$8,919,326 less than in 1930 and the lowest in any year since detailed records were begun in 1903. The output of all five metals decreased, particularly zinc, lead, and silver, which fell 43, 24, and 21 per cent, respectively. The average total value of the ore and old tailings in 1931 was $8.72 in recovered metals a ton.

Most of the ore (98.42 per cent) was concentrated and produced 201,339 tons of concentrates yielding on the average $49.70 in metals a ton. The statement to the county assessor gave $1,586,377 as the net profits of the Coeur d'Alene mines and leases in 1931, a decrease from $4,383,872 in 1930. The gross value of the ore and concentrates produced in 1931, as reported by the assessor, was $11,290,120, a notable decrease compared with $17,316,933 in 1930 and $25,658,061 in 1929.

For details on development and recent articles on the mining industry of Idaho, reference is again made to the annual report of the State mine inspector for 1931 (see p. 438).

Beaver district.—The output of the Beaver district consisted of placer bullion valued at $1,055 from 6 properties near Delta; the Accident and Otto claims were the chief producers. No lode mines were productive in 1931.

Eagle district (*Murray*).—The Jack Waite Mining Co., the only producer in the Eagle district in 1931, continued operations at the Jack Waite group in Idaho and the adjoining Silver King group in Montana. The total output of ore in 1931 from both the Idaho and Montana sections of the mine was more than double that in 1930. Nearly 3,000 tons of first-class lead ore containing more than 64 per cent lead were shipped to Bradley for smelting, and about 71,000 tons of lead-zinc ore were treated in the new company 500-ton flotation plant; the total output of lead is about 10 times that of zinc. The total production of lead, zinc, and silver was much greater than in 1930, but the production from the Idaho section was less. Production from the eastern section of the property is credited to Sanders County, Mont.

Evolution district.—The Yankee Boy mine of the Sunshine Mining Co. was the only producer in the Evolution district in 1931. The output of ore was considerably greater than in 1930. The flotation mill treated 183,441 tons of copper-lead ore rich in silver, and about 4,000 tons of concentrates containing nearly 605 ounces of silver to the ton were shipped to the lead smelter at Bradley. The output of silver from the mine increased more than 4 per cent over 1930, and the property was again the largest producer of silver in Idaho and ranked second in the United States. The income from ore sales amounted to $624,316, and after various operating expenses were deducted the gross profit was $62,005. Dividends amounting to $29,776 were paid during 1931, a total of $897,988 to date. The surplus at the end of the year was $112,844.

Hunter district (*Mullan*).—Five lode mines in the Hunter district produced 252,617 tons of ore yielding $4,412 in gold, 864,744 ounces of silver, 123,742 pounds of copper, 40,407,941 pounds of lead, and 25,783,755 pounds of zinc, valued in all at $2,741,326 ($10.85 in metals a ton), a decrease of $3,334,204 (55 per cent) from 1930. The marked decrease in output of lead, zinc, and silver resulted chiefly from drastic curtailment in the output of lead-zinc ore from the Morning mine. The total output from the district in 1931 consisted of 185 tons of first-class ore and of 252,432 tons of concentrating ore, which was reduced to 52,331 tons of concentrates.

The output of ore from the Morning mine of the Federal Mining & Smelting Co. decreased nearly 36 per cent from 1930, as the mine was operated in 1931 on a 12 day per month basis from June 1 to December 31. From 231,619 tons of lead-zinc ore of milling grade the company made lead concentrates containing 670,353 ounces of silver and 38,012,352 pounds of lead and zinc concentrates containing 183.23 ounces of gold, 95,447 ounces of silver, 1,227,671 pounds of lead, and 25,719,970 pounds of zinc. In addition, lessees produced 118 tons of first-class lead ore of smelting grade and 748 tons of lead-zinc milling ore together containing 14,348 ounces of silver, 275,646 pounds of lead, and 108,431 pounds of zinc. Although the output of all metals decreased decidedly, the mine produced more than 60 per cent of the State's total output of zinc, ranked third in production of lead and fourth in silver. The earnings from the Morning mine were $65,170 in 1931, compared with $766,091 in 1930. Ore reserves at the end of the year were estimated at 1,565,000 tons of developed ore, a decrease of 155,700 tons from the estimated tonnage at the end of 1930. The company, which also owns mines in Kansas, Missouri, and Oklahoma, paid dividends amounting to $104,562 in 1931 (a total of $24,292,528 to date) and had a surplus of $5,865,832 at the end of the year.

According to figures given the county assessor the concentrates produced from the Morning mill had a gross value of $2,433,456; after various costs, including freight, treatment, betterment, and repairs, were deducted the net profit was $175,683.

The Golconda Lead Mines operated its mine and 250-ton flotation mill on a 1-shift basis and treated 16,143 tons of lead-zinc ore. In all, 3,133 tons of lead concentrates and zinc concentrates containing more than 78,000 ounces of silver, 2,200,000 pounds of lead, and nearly 2,000,000 pounds of zinc were shipped, having a gross value of more than $175,000. After various costs were deducted the net loss was $9,534. There were no regular operations at the Star mine in 1931, but more than 2,600 tons of lead-zinc ore were treated in the South mill of the Bunker Hill & Sullivan Mining & Concentrating Co. The Atlas Mining Co. operated its mine from April 1 to August 23, and treated 1,260 tons of lead ore in the Gold Hunter mill.

Lelande district (*Burke, Mace, Frisco*).—Eight lode mines in the Lelande district produced 225,388 tons of ore yielding $668 in gold, 1,366,073 ounces of silver, 220,639 pounds of copper, 49,802,716 pounds of lead, and 3,501,136 pounds of zinc, valued in all at $2,392,650 or $10.62 in metals a ton. The output consisted of 15,758 tons of first-class ore and of 209,630 tons of concentrating ore which was reduced to 36,816 tons of concentrates. The value of the district output decreased $1,782,231 from 1930, due chiefly to curtailed operations at the Hecla and Sherman mines.

The Hecla Mining Co. at Burke, which shipped first-class lead ore and lead concentrates to the Bunker Hill smelter at Bradley and zinc concentrates to the electrolytic plant of the Sullivan Mining Co. at Silver King, was as usual the largest producer in the district; its output of lead, however, decreased more than 9,000,000 pounds from 1930, and that of silver also decreased considerably.

Of the ore mined, 184,559 tons were milled at Gem in the company 750-ton mill equipped for gravity and flotation concentration, making 31,568 tons of concentrates which, with 15,468 tons of crude ore, contained 1,271,869 ounces of silver, 47,893,419 pounds of lead, and 758,322 pounds of zinc. Ore reserves at the end of the year were 1,806,578 tons; dividends amounting to $400,000 were paid in 1931, a total of $20,105,000 to date. The company ranked second in production of lead in Idaho in 1931 and third in silver.

According to figures given the county assessor the crude ore and concentrates had a gross value of $2,162,941; after various costs, including extraction, freight, treatment, betterment, and repairs, were deducted the net profit was $560,956. At the end of 1931 the company had a surplus of $5,181,349.

The Sherman Lead Co. operated its mine on a reduced basis until the end of May, when all operations were suspended. The output of ore decreased from 29,847 tons in 1930 to 7,633 tons in 1931; the entire output was lead ore treated at the Hercules mill. According to the printed annual company report for 1931, the gross income from the ore was $27,853; after various operating expenses were deducted the net income was $4,126 before allowance for Federal and State income taxes.

The Hull Leasing Co. continued to operate the Frisco mine of the Federal Mining & Smelting Co. and treated several thousand tons of lead-zinc ore in its 75-ton flotation plant. In all, 3,466 tons of lead concentrates and zinc concentrates containing 25,834 ounces of silver, 1,050,155 pounds of lead, and 3,014,433 pounds of zinc were shipped, having a gross value of $129,641. The company also shipped 2 cars of first-class silver-lead ore.

The Mutual Mines Development Co. operated the Formosa group and its new 100-ton flotation plant from April 15 to November 15, when the mine and mill were closed as a result of low metal prices. About 2,000 tons of lead ore were treated and 268 tons of concentrates containing 37 ounces of silver to the ton and 70 per cent lead were shipped to East Helena, Mont., and Bradley, Idaho.

The remainder of the district output consisted of lead ore from the Mace, Hercules, and Ambergris mines and a little lead-zinc ore from the Humming Bird property.

Placer Center district (*Sunset*).—Four lode mines in the Placer Center district produced 9,481 tons of ore yielding 77,258 ounces of silver, 19,577 pounds of copper, 2,289,084 pounds of lead, and 177,376 pounds of zinc, valued in all at $115,623, or $12.20 in metals a ton. The output consisted of 319 tons of first-class smelting ore and of 9,162 tons of concentrating ore which was reduced to 2,093 tons of concentrates. The value of the district output declined from $1,893,329 in 1929 to $703,102 in 1930 and to $115,623 in 1931, as the large producers were idle part of 1930 and most of 1931.

The property of the Dayrock Mining Co. was closed in May on account of continued decline in metal prices. The output in 1931 was only a little more than one-fifth that in 1930 and consisted of 6,463 tons of milling ore containing 54,424 ounces of silver and 1,585,933 pounds of lead. According to a statement to the county assessor the ore had a gross value of $38,943 in 1931 compared with $241,431 in 1930. Dividends of $253,905 have been paid to date; none were paid in 1931.

The output from the Tamarack & Custer mine decreased from 20,334 tons of ore containing 53,004 ounces of silver, 2,672,947 pounds of lead, and 2,757,345 pounds of zinc in 1930 to 1,961 tons of ore containing 24,859 ounces of silver, 919,724 pounds of lead, and 87,332 pounds of zinc in 1931. The production in 1931 came from lessees' operations on the upper levels of the mine, as no stoping was done on company account. The output consisted of 1,643 tons of lead-zinc ore treated in the Hercules flotation mill and 318 tons of first-class lead ore shipped to East Helena, Mont.

Milling operations were suspended at the Galena mine of the Callahan Zinc-Lead Co. in February. The output of ore declined from about 11,600 tons in 1930 to less than 700 tons in 1931. The ore was treated in the company 200-ton flotation plant, and lead concentrates were shipped to East Helena, Mont., for smelting.

The remainder of the district output consisted of 393 tons of lead-zinc ore from the Success mine treated in the Hercules flotation mill.

St. Joe district.—Placer gold valued at $199 was marketed from the Gold Producer claim on the North Fork of the Clearwater River.

Summit district (Murray).—The output of the Summit district consisted of 195 tons of ore, old tailings, etc., yielding metals valued at $7,017. Most of the material was first-class lead ore of smelting grade from the Bear Top group, operated by lessees.

Yreka district (Kellogg).—Eight lode mines in the Yreka district produced 545,064 tons of ore yielding $1,338 in gold, 2,272,280 ounces of silver, 293,508 pounds of copper, 98,736,353 pounds of lead, and 8,096,826 pounds of zinc, valued in all at $4,647,933, or $8.53 in metals a ton. The value of the district output declined $2,898,757 (more than 38 per cent) from 1930; the output of all five metals decreased considerably due chiefly to curtailment of operations at nearly all the larger producers and to inactivity of the Constitution Mining & Milling Co. The district output consisted of 2,195 tons of first-class smelting ore and of 542,869 tons of milling ore which yielded 104,255 tons of concentrates.

The Bunker Hill & Sullivan Mining & Concentrating Co., the largest mining enterprise in Idaho, continued its mining, milling, smelting, refining, and fabricating operations at normal capacity throughout the year. The West or main mill of 1,300 tons capacity was operated continuously during 1931 on Bunker Hill ore; the 500-ton South or Star mill was operated a short time on ore from the Star mine; and the 200-ton Sweeny mill was operated the latter half of 1931 on custom ore, chiefly lead-zinc ore from the Sidney mine. The Bunker Hill & Sullivan property is opened by the long Kellogg tunnel, which intersects the mine workings nearly 1,500 feet vertically below the outcrop. At a point about 10,000 feet from the portal there are two inclined underground shafts from this tunnel to the 2,000-foot level; about 5,831 feet of development were done in 1931. The property was by far the largest producer of lead in Idaho in 1931 and ranked second as a producer of silver and zinc. According to the printed company report for 1931 the mine produced 460,366 tons of ore which was reduced to 89,839 tons of concentrates containing 1,725,733 ounces of silver, 88,462,471 pounds of lead, and 9,982,591 pounds of zinc. This output, however, does not include the first-class smelting ore shipped by lessees from the Bunker Hill property and the lead ore mined by lessees and shipped to the Sweeny custom mill. The ratio of concentration at the main mill was 5.12 to 1, and the costs per ton of ore mined were as follows: Mining,

$3.454; concentrating, $0.834; shipping, $0.028; other costs, $0.363; a total of $4.679.

According to figures given the county assessor the ore mined and treated by the company (excluding lessees' ore) had a gross value of $4,610,564; after various costs, including extraction, freight, treatment, betterment, and repairs, were deducted, the net profit was $667,161 compared with $1,611,363 in 1930. Dividends aggregated $553,246 in 1931, a total of $48,444,489 paid since 1890.

From 1886 to the end of 1931 the company has mined 13,925,786 tons of ore having a gross value of $167,163,780; net smelter returns have been $103,229,696 and operating profit $55,718,158.

The Bunker Hill smelter and refinery ran continuously in 1931, largely on ore and concentrates from the Bunker Hill and Hecla mines but partly on custom ore from Western States, Alaska, and British Columbia. The output of the smelter in 1931 was 77,687 tons of lead, 10,049,526 ounces of silver, and 44,841.45 ounces of gold, compared with 84,405 tons of lead, 10,272,081 ounces of silver, and 46,000.5 ounces of gold in 1930; all the gold came from purchased ores. The decrease in smelter output resulted from the decline in custom material received.

The Crescent mine and mill, controlled by the Bunker Hill & Sullivan Mining & Concentrating Co., operated continuously on an 8-hour basis during 1931. About 12,000 tons of copper-lead ore were treated in the 120-ton flotation plant, and concentrates containing chiefly silver were shipped to the smelter at Bradley.

The Federal Mining & Smelting Co. operated the Page and Blackhawk mines on a reduced basis. According to the printed annual company report for 1931 the 300-ton flotation mill at the Page property treated 41,134 tons of lead-zinc ore from the Page mine and 13,775 tons of similar ore from the Blackhawk mine. Lead concentrates and zinc concentrates produced from Page ore contained 13.70 ounces of gold, 164,359 ounces of silver, 8,167,218 pounds of lead, and 1,200,371 pounds of zinc, valued at $390,314. Lead concentrates and zinc concentrates produced from Blackhawk ore contained 4.55 ounces of gold, 54,683 ounces of silver, 2,718,616 pounds of lead, and 404,410 pounds of zinc, valued at $130,837. The output of each metal from both properties was much less in 1931 than in 1930. The net earnings from Page ore amounted to $50,756 in 1931 compared with $240,625 in 1930; the net earnings from Blackhawk ore amounted to $12,496 compared with $24,328.

The Sidney Leasing Co. continued to operate the Sidney mine on a development basis until August 1 and during the last five months of the year shipped more than 12,000 tons of lead-zinc ore to the Sweeny flotation mill where the ore is separated into lead concentrates and zinc concentrates. The milling ore contained 28,498 ounces of silver, 1,387,054 pounds of lead, and 3,198,187 pounds of zinc, a decided decrease from 1930. The mine ranked fourth as a producer of zinc in Idaho in 1931 and tenth as a producer of lead; it was also a large producer of silver.

The remainder of the district output consisted of 766 tons of lead ore from the Sierra Nevada mine, 238 tons of copper-lead ore from the Caledonia mine containing nearly 127 ounces of silver to the ton, and 115 tons of silver-lead ore from the Stewart property.

TWIN FALLS COUNTY

Snake River district.—Operations at five placer properties on the Snake River near Twin Falls yielded bullion valued at $613; the Sandy Bar placer was the chief producer.

VALLEY COUNTY

The value of the production of metals in Valley County decreased from $316,484 in 1930 to $116,333 in 1931 as a result of the closing, in May, of the Lost Pilgrim & Hall-Interstate property of the Bunker Hill & Sullivan Mining & Concentrating Co.

Deadwood Basin district (Cascade).—The Bunker Hill & Sullivan Mining & Concentrating Co. operated the Lost Pilgrim & Hall-Interstate group the first five months of 1931, after which the property was closed as a result of low metal prices. Nearly 11,000 tons of lead-zinc ore were treated in the 100-ton flotation mill before the mine was closed. Lead concentrates, exceptionally rich in silver, were shipped to Bradley for smelting, and zinc concentrates were shipped to the electrolytic zinc plant at Silver King.

Lake City district.—A little gold bullion was produced from sluicing at the Boulder Queen placer in Blue Gulch near McCall.

Payette River district.—Gold bullion valued at $95 was marketed from placer operations on the Payette River near Roseberry.

Seafoam district.—A little gold bullion was marketed from hydraulicking at the Alta Fay placer north of Lowman.

Thunder Mountain district.—The Sunnyside Mining & Milling Co. continued operations at the Sunnyside group and treated 500 tons of siliceous gold ore in a 10-stamp amalgamation mill. Bullion valued at more than $2,800 was sent to the assay office at Boise.

Yellow Pine district.—The Amalgamated Red Metals Mines Co. treated about 70 tons of lead ore rich in gold and silver in the 15-ton combined gravity and flotation concentrator. The concentrates and a little first-class smelting ore were trucked to Midvale, Utah, for smelting.

The Yellow Pine Co. continued its development program at the Meadow Creek and Cinnabar properties near Yellow Pine and Stibnite. The company reported 8,000 feet of development during the year, chiefly in advancing the Monday and Cinnabar tunnels. The company erected a 125-ton experimental mill in 1931 at the portal of the old Meadow Creek tunnel. Operation of the pilot mill, however, was not begun until 1932. The mill will be used to work out the details of the milling methods to be employed in treating the gold-antimony ore.

WASHINGTON COUNTY

Weiser (Unorganized) district.—A test lot of gold ore from a prospect near Weiser was treated by amalgamation.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN WASHINGTON[1]

(MINE REPORT)

By C. N. Gerry and T. H. Miller[2]

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SUMMARY

The value of the mine production of gold, silver, copper, lead, and zinc in Washington increased more than 62 per cent—from $348,630 in 1930 to $565,498 in 1931. The increase resulted from activity of the Pend Oreille Mines & Metals Co. at its mine and mill near Metaline Falls, Pend Oreille County. The output of gold, silver, and copper decreased decidedly, the largest decreases being in copper from Snohomish County, gold from Whatcom County, and silver from Stevens County. There was also a large decrease in output of lead from Stevens County, but this loss was more than offset by the large increase in both lead and zinc from Pend Oreille County.

Since 1860 Washington has yielded an output of the five metals as follows: Gold, $30,482,780; silver, 9,307,090 fine ounces; copper, 27,057,591 pounds; lead, 65,981,032 pounds; and zinc, 25,629,029 pounds. The total value has amounted to $48,029,388, of which 63 per cent represents the value of gold. During the decade 1922 to 1931 gold represents 29 per cent of the total value of the metal output; silver, nearly 13 per cent; copper, 19 per cent; lead, nearly 24 per cent; and zinc, 15 per cent. No dividends were paid by any metal-mining company in the State in 1931.

The value of the metal output of Pend Oreille County increased $410,963 because of increased output of lead-zinc ore from the Josephine (Pend Oreille Mines & Metals Co.) mine near Metaline Falls, but the value of the metal output of Snohomish County decreased $137,681 because of decreased output of copper ore from the Sunset mine near Index. The output of lead ore from mines near Northport, Stevens County, also decreased, and the total value of the metal output of the county dropped from $44,686 in 1930 to $16,211 in 1931. The value of the metal output of Whatcom County decreased from $71,822 in 1930 to $12,475 in 1931 as a result of decreased output of gold ore from the Boundary Red Mountain mine. Nearly 84 per cent of the total value of the State metal output in 1931 came from lead and zinc concentrates shipped from the Josephine mill in Pend Oreille County.

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[1] Work on manuscript completed September, 1932.

[2] The assistance of Paul Luff and LaRu Shepherd, of the Bureau of Mines, is acknowledged.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064
1928	.585	.144	.058	.061
1929	.533	.176	.063	.066
1930	$0.385	$0.130	$0.050	$0.048
1931	.290	.091	.037	.038

Mine production of gold, silver, copper, lead, and zinc in Washington, 1927–1931, in terms of recovered metals

Year	Mines producing		Ore and old tailings (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1927	30	3	119,201	19,513.51	$403,380	155,850	$88,367
1928	37	1	64,554	16,310.45	337,167	99,738	58,347
1929	29	4	93,527	3,719.94	76,898	47,182	25,148
1930	24	14	45,456	4,244.81	87,748	32,816	12,634
1931	24	21	92,049	2,904.19	60,035	22,410	6,499

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1927	1,685,848	$220,846	955,003	$60,165	1,279,710	$81,901	$854,659
1928	1,177,246	169,523	1,084,739	62,915	85,318	5,204	633,156
1929	1,400,489	246,486	1,015,190	63,956	2,117,344	139,745	552,233
1930	1,206,438	156,837	1,152,585	57,629	703,782	33,782	348,630
1931	202,503	18,428	2,771,116	102,531	9,947,495	378,005	565,498

Gold and silver produced at placer mines in Washington, 1927–1931, in fine ounces

Year	Gold	Silver
1927	18.82	5
1928	90.85	30
1929	295.76	98
1930	190.90	43
1931	153.06	12

GOLD

The production of gold in Washington decreased from 4,244.81 ounces in 1930 to 2,904.19 ounces in 1931 and was less than one-third the yearly average for the last decade. The decrease was due chiefly to greatly diminished output of the Boundary Red Mountain mine in Whatcom County. There was a good increase in output of gold from Ferry County, as some of the mines at Republic were active again after being idle in 1930. The largest producer of gold in Washington in 1931 was the Knob Hill mine at Republic. More than 67 per cent of the total gold was recovered from gold ore of smelting grade from mines in the Republic district, Ferry County; most of the remainder came from amalgamating gold ore from the Boundary Red Mountain mine, Whatcom County, and from placer operations.

SILVER

The production of silver in Washington in 1931 was less than in any year since 1894. The output has been decreasing steadily since 1926; it fell from 32,816 ounces in 1930 to 22,410 ounces in 1931. Nearly 86 per cent of the total in 1931 came from the United Copper mine near Chewelah, Stevens County, the Knob Hill mine at Republic, Ferry County, and the Josephine mine near Metaline Falls, Pend Oreille County. Copper ore yielded 46 per cent of the total silver, siliceous gold ore nearly 33 per cent, and lead-zinc ore more than 20 per cent.

COPPER

The production of copper in Washington in 1931 decreased more than 83 per cent in quantity from that in 1930, and was less than one-fifth the annual average (1,030,113 pounds) for the decade 1922 to 1931. Most of the decrease in 1931 was caused by marked curtailment in the output of copper ore from the Sunset mine near Index, Snohomish County. The mine was again the largest producer of copper in the State although the output in 1931 was comparatively small; the next largest producer was the United Copper property at Chewelah.

LEAD

The production of lead in Washington in 1931 was 2,771,116 pounds, nearly 2½ times that in 1930 and 9 per cent above the annual average for the decade 1922 to 1931. Nearly 91 per cent of the total in 1931 came from lead-zinc ore from the Josephine (Pend Oreille Mines & Metals Co.) mine near Metaline Falls. The output of lead from mines near Northport, Stevens County, was small in 1931 compared with past years.

ZINC

The production of zinc in Washington in 1931 was 9,947,495 pounds, a marked increase from 703,782 pounds in 1930 and nearly five times the annual average (2,155,950 pounds) for the decade 1922 to 1931. The entire output came from the Josephine property of the Pend Oreille Mines & Metals Co. near Metaline Falls, where nearly 81,000 tons of lead-zinc ore were treated by flotation.

Mine production of gold, silver, copper, lead, and zinc in Washington in 1931, by counties, in terms of recovered metals

County	Gold (lode and placer)		Silver (lode and placer)	
	Fine ounces	Value	Fine ounces	Value
Asotin	1.55	$32		
Chelan	40.20	831	14	$4
Ferry	1,969.15	40,706	7,021	2,036
Kittitas	88.04	1,820	24	7
Okanogan	82.09	1,697	68	20
Pend Oreille	15.67	324	4,595	1,333
Snohomish	10.60	219	1,350	391
Stevens	90.70	1,875	9,303	2,698
Whatcom	603.00	12,465	35	10
Whitman	3.19	66		
	2,904.19	60,035	22,410	6,499
Total, 1930	4,244.81	87,748	32,816	12,634

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Asotin							$32
Chelan	705	$64	403	$15			914
Ferry							42,742
Kittitas							1,827
Okanogan	791	72	163	6			1,795
Pend Oreille	2,670	243	2,514,977	93,054	9,947,495	$378,005	472,959
Snohomish	174,362	15,867					16,477
Stevens	23,975	2,182	255,573	9,456			16,211
Whatcom							12,475
Whitman							66
	202,503	18,428	2,771,116	102,531	9,947,495	378,005	565,498
Total, 1930	1,206,438	156,837	1,152,585	57,629	703,782	33,782	348,630

Ore and old tailings sold or treated and lode mines producing in Washington, 1930 and 1931, by counties

County	Ore and old tailings (short tons)		Lode mines producing		County	Ore and old tailings (short tons)		Lode mines producing	
	1930	1931	1930	1931		1930	1931	1930	1931
Chelan	600	130	1	1	Snohomish	27,809	5,000	1	1
Ferry	559	3,736	5	5	Stevens	2,107	386	9	9
Kittitas	34	10	2	3	Whatcom	7,106	1,779	2	1
Okanogan	9	40	1	3					
Pend Oreille	7,232	80,968	3	1		45,456	92,049	24	24

MINING INDUSTRY

In 1931 Washington was the only State in the West that recorded decided increase in value of metal output. The increase (more than 62 per cent), however, did not indicate a prosperous condition in the mining industry of Washington, for, with one exception, all the large producers in the State showed decided decreases. The mine and flotation plant of the Pend Oreille Mines & Metals Co. at Metaline Falls were operated continuously in 1931, and the property produced nearly 81,000 tons of lead-zinc ore compared with about 6,000 tons in 1930; the marked increase at this property exceeded the total increase in value of the State's metal output. The output of gold from mines at Republic increased, but this gain was more than offset by the large decrease in output from Whatcom County. There was also a marked decline in activities at the lead mines at Northport and at the copper properties at Index and Leavenworth. In general, the mines in Washington have been seriously affected by the sharp decline in the price of silver, copper, lead, and zinc. Some interest was shown in working placer property.

ORE CLASSIFICATION

Ore sold or treated in Washington in 1931, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	18	5,779	2,725.53	7,316	936	559	
Copper ore	3	5,063	25.60	10,322	198,698	7	
Lead ore	2	239		165	199	255,573	
Lead-zinc ore	1	80,968		4,595	2,670	2,514,977	9,947,495
Total, lode mines	24	92,049	2,751.13	22,398	202,503	2,771,116	9,947,495
Total, placers	21		153.06	12			
	45	92,049	2,904.19	22,410	202,503	2,771,116	9,947,495
Total, 1930	38	[1] 45,456	4,244.81	32,816	1,206,438	1,152,585	703,782

[1] Includes 13 tons of old tailings sold to a smelter.

Value of metals from ore sold or treated in Washington in 1931, by classes of ore

Class	Ore (short tons)	Gold	Silver	Copper	Lead	Zinc	Total value
Dry gold ore	5,779	$56,342	$2,122	$85	$20		$58,569
Copper ore	5,063	529	2,993	18,082	1		21,605
Lead ore	239		48	18	9,456		9,522
Lead-zinc ore	80,968		1,332	243	93,054	$378,005	472,634
	92,049	56,871	6,495	18,428	102,531	378,005	562,330
Total, 1930	[1] 45,456	83,802	12,618	156,837	57,629	33,782	344,668

[1] Includes 13 tons of old tailings sold to a smelter.

DRY AND SILICEOUS ORE

Most of the dry and siliceous ore (nearly 65 per cent) in 1931 was gold ore of smelting grade from mines near Republic, Ferry County; nearly all the remainder was gold ore treated by amalgamation from the Boundary Red Mountain mine in Whatcom County. The total value of metals recovered from gold ore was $58,569. No silver ore or gold and silver ore was treated or marketed in Washington in 1931.

COPPER ORE

Copper ore yielded metals valued at $21,605 in 1931, a decrease from $169,248 in 1930. Nearly all the copper ore came from the Sunset mine at Index, Snohomish County, and most of it was treated by concentration.

LEAD ORE

The metals recovered from lead ore in 1931 were valued at $9,522, a decrease from $31,967 in 1930. All the lead ore produced in 1931 was first-class smelting ore from the Electric Point and Gladstone mines near Northport, Stevens County. The large decrease from 1,981 tons in 1930 to 239 tons in 1931 resulted chiefly from the closing of the Bonanza mine and mill near Bossburg, also in Stevens County.

LEAD-ZINC ORE

Lead-zinc ore yielded metals valued at $472,634 in 1931 (nearly 84 per cent of the total value for the State and an increase of $411,700 over 1930). All the lead-zinc ore (80,968 tons) was concentrated; it came from the property of the Pend Oreille Mines & Metals Co. at Metaline Falls, Pend Oreille County.

Ore sold or treated in Washington in 1931, by counties, with content in terms of recovered metals

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
DRY GOLD ORE						
Chelan	130	31.00	14	705	403	
Ferry	3,736	1,959.14	7,021			
Kittitas	10	38.94	16			
Okanogan	37	26.00	56	231	156	
Stevens	87	67.45	174			
Whatcom	1,779	603.00	35			
	5,779	2,725.53	7,316	936	559	
Total, 1930	[1] 7,710	3,953.14	1,726	935	270	
COPPER ORE						
Okanogan	3	11.00	8	560	7	
Snohomish	5,000	10.60	1,350	174,362		
Stevens	60	4.00	8,964	23,776		
	5,063	25.60	10,322	198,698	7	
Total, 1930	28,565	100.43	27,592	1,204,218		
LEAD ORE						
Stevens	239		165	199	255,573	
	239		165	199	255,573	
Total, 1930	1,981	0.34	2,435	970	617,945	
LEAD-ZINC ORE						
Pend Oreille	80,968		4,595	2,670	2,514,977	9,947,495
	80,968		4,595	2,670	2,514,977	9,947,495
Total, 1930	7,200		1,020	315	534,370	703,782

[1] Includes 13 tons of old tailings sold to a smelter.

Zinc products produced or marketed from Washington mines and mills in 1931

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of concentrates	Recovered zinc
		Short tons	*Pounds*	*Per cent*	*Pounds*
Zinc concentrates	Pend Oreille	9,085	10,854,970	59.74	9,947,495
		9,085	10,854,970	59.74	9,947,495
Total, 1930		715	799,752	55.93	703,782

METALLURGIC INDUSTRY

Nearly 94 per cent of the total ore from Washington treated in 1931 was concentrated, chiefly lead-zinc ore from the property of the Pend Oreille Mines & Metals Co., Pend Oreille County; nearly 2 per cent was gold ore amalgamated, chiefly from the Boundary Red Mountain mine in Whatcom County; and nearly 5 per cent was crude ore shipped for smelting, chiefly gold ore from the Knob Hill mine at Republic, Ferry County.

Four milling plants in Washington were active in 1931. One used flotation, one a combination of flotation and table concentration, one gravity concentration, and one amalgamation.

Ore and concentrates from mines in Washington were smelted mainly at Bradley, Idaho; Tacoma, Wash.; and Trail, British Columbia. Lead ore and concentrates were smelted at the Bunker Hill plant at Bradley, Idaho; copper material at Tacoma, Wash.; and siliceous ore at Trail, British Columbia, and Tacoma, Wash. Zinc concentrates were shipped to East St. Louis, Ill., for reduction. At Trail, British Columbia, in addition to electrolytic lead and zinc plants, the smelter is equipped for the recovery of electrolytic bismuth, cadmium, and antimony; a zinc fuming plant was added in 1930, and a large new fertilizer plant was under construction in 1931.

The total ore concentrated in 1931 yielded 11,203 tons of concentrates; 81 per cent was zinc concentrates, 16 per cent lead concentrates, and the remainder copper and gold concentrates. The Josephine mill of the Pend Oreille Mines & Metals Co. was the only plant in Washington that operated full time in 1931. The Sunset plant at Index was operated intermittently by lessees. The new plant of the Royal Development Co., north of Leavenworth, was idle. The ore concentrated in 1931, however, has been separated by classes, and an estimate has been made of the gross metal content of the mill feed. The gross metal content of the concentrates is also given, as well as the metals estimated to have been recovered.

Washington ore concentrated in 1931, by classes of ore, with gross metal content of mill feed

Class of ore	Quantity (dry weight)	Gross content of mill feed by assay				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Siliceous gold	130	40.00	20	910	840	
Copper	5,000	15.00	2,000	210,000		
Lead-zinc	80,968		6,530	4,700	3,433,043	13,197,784
	86,098	55.00	8,550	215,610	3,433,883	13,197,784
Total, 1930	36,886	116.20	14,900	1,303,770	729,500	999,000

Washington ore concentrated in 1931, by methods of concentration

Method of concentration	Ore concentrated	Concentrates and metal content		
		Concentrates produced	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*
Flotation	80,968	10,850		4,595
Gravity and flotation	5,000	320	10.60	1,350
Gravity	130	33	31.00	14
	86,098	11,203	41.60	5,959
Total, 1930[1]	36,886	3,020	92.43	11,983

Method of concentration	Concentrates and metal content—Continued					
	Copper		Lead		Zinc	
	Gross	Recovered	Gross	Recovered	Gross	Recovered
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Flotation	3,338	2,670	2,646,118	2,514,977	10,854,970	9,947,495
Gravity and flotation	179,200	174,362				
Gravity	727	705	672	403		
	183,265	177,737	2,646,790	2,515,380	10,854,970	9,947,495
Total, 1930[1]	1,172,381	1,136,791	660,107	627,991	799,752	703,782

[1] No mills using gravity concentration only were active in 1930.

Gross metal content of Washington concentrates produced in 1931, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	33	31.00	14	727	672	
Copper	320	10.60	1,350	179,200		
Lead	1,765		4,595	3,338	2,416,151	
Zinc	9,085				229,967	10,854,970
	11,203	41.60	5,959	183,265	2,646,790	10,854,970
Total, 1930	3,020	92.43	11,983	1,172,381	660,107	799,752

Mine production of metals from Washington concentrates in 1931, in terms of recovered metals

BY COUNTIES

	Ore to concentrating mills	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Chelan	130	33	31.00	14	705	403	
Pend Oreille	80,968	10,850		4,595	2,670	2,514,977	9,947,495
Snohomish	5,000	320	10.60	1,350	174,362		
	86,098	11,203	41.60	5,959	177,737	2,515,380	9,947,495
Total, 1930	36,886	3,020	92.43	11,983	1,136,791	627,991	703,782

BY CLASSES OF CONCENTRATES

	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	33	31.00	14	705	403	
Copper	320	10.60	1,350	174,362		
Lead	1,765		4,595	2,670	2,319,505	
Zinc	9,085				195,472	9,947,495

Most of the crude ore shipped to smelters was gold ore from the Knob Hill mine at Republic, Ferry County. There was a decided increase in gold ore shipped to smelters but a large decrease in first-class lead ore.

Gross metal content of Washington crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Quantity (dry weight)	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous	3,857	2,048.64	7,250	238	271
Copper	63	15.00	8,972	25,088	11
Lead	239		165	279	266,222
	4,159	2,063.64	16,387	25,605	266,504
Total, 1930	1,454	490.93	20,580	72,142	546,736

Mine production of metals from Washington crude ore shipped to smelters in 1931, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Ferry	3,736	1,959.14	7,021		
Okanogan	40	37.00	64	791	163
Stevens	383	67.50	9,302	23,975	255,573
	4,159	2,063.64	16,387	24,766	255,736
Total, 1930	1,454	490.93	20,580	69,647	524,594

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead
Dry and siliceous	3,857	2,048.64	7,250	231	156
Copper	63	15.00	8,972	24,336	7
Lead	239		165	199	255,573

REVIEW BY COUNTIES AND DISTRICTS

Notes usually given under the district reviews in this series of reports have been greatly curtailed in an effort to reduce the size of the chapters for 1931. Details on development, notes from printed reports, and statements comparing the production of the current year with that of past years have been omitted unless of unusual importance.

CHELAN COUNTY

Blewett district.—One car of gold concentrates produced from the old Blewett property several years ago was shipped in 1931. A little placer gold from the Solita property on Peshastin Creek was recovered by sluicing.

Chelan Lake district.—The Chelan Copper Mining Co. continued development at the Holden group and did 2,798 feet of work in 1931.

Leavenworth district.—The Red Mountain property of the Royal Development Co. 40 miles north of Leavenworth was idle in 1931.

Wenatchee River district.—A little gold from the Wednesday placer near Dryden on the Wenatchee River was recovered by sluicing.

FERRY COUNTY

The value of the metal output from mines in Ferry County was $42,742 in 1931, compared with $10,177 in 1930. The gain in output resulted from increased shipments of gold ore from the Knob Hill mine at Republic.

Columbia River district.—Placer bullion valued at $207 was recovered from bars on the Columbia River near Kettle Falls.

Republic district.—Five lode mines in the Republic district produced 3,736 tons of ore yielding $40,499 in gold and 7,021 ounces of silver, valued together at $42,535, an increase of $33,274 over the district output in 1930. The largest producer in the district and the largest gold producer in the State in 1931 was the Knob Hill mine. The property was operated by lessees who shipped more than 3,000 tons of first-class gold ore. Other producers of first-class gold ore were the Old Republic, San Poil, Old Hickory, and Last Chance mines. From 1896 to the end of 1931 the district produced 708,510 tons of ore and old tailings yielding $8,696,348 in gold, 2,582,125 ounces of silver, and 236 pounds of lead, valued in all at $10,316,962.

KITTITAS COUNTY

Swauk district.—Two placers and three lode mines in the Swauk district produced 10 tons of ore, $1,820 in gold, and 24 ounces of silver, valued together at $1,827. The placer output was valued at $1,018 and came chiefly from sluicing operations at the Triple B property near Trinidad. The ore was treated by amalgamation and came chiefly from the Sunrise mine near Liberty.

OKANOGAN COUNTY

Meyers Creek district.—The placer output from the Meyers Creek district was valued at $619 and came chiefly from the Walker claims 6 miles from Molson.

Palmer Mountain district.—A test lot of gold ore from the Granite Quartz property near Oroville was shipped to Tacoma for smelting.

Similkameen district.—Placer operations at the Slate Rock and other properties on the Similkameen River produced bullion valued at $314.

Upper Methow district.—One car of siliceous gold ore from the Mazama Pride group and a test lot of copper ore containing considerable gold from the Mountain Beaver property, both near Mazama, were shipped to Tacoma for smelting.

PEND OREILLE COUNTY

The value of the metal output of Pend Oreille County increased from $61,996 in 1930 to $472,959 in 1931, as a result of continuous operations at the mine and 300-ton flotation plant of the Pend Oreille Mines & Metals Co. near Metaline Falls.

Metaline district (*Metaline Falls*).—The total value of the metal output of the Metaline district was $472,959, the largest ever recorded. The entire output, except $324 recovered from placer operations on the Pend Oreille River near Metaline Falls, was lead-zinc ore from the Josephine mine of the Pend Oreille Mines & Metals Co. The company operated its mine and 300-ton flotation mill continuously and treated 80,968 tons of lead-zinc ore; the resulting lead and zinc concentrates (10,850 tons) contained 4,595 ounces of silver, 2,646,118 pounds of lead, and 10,854,970 pounds of zinc. The property was the only producer of zinc and by far the largest producer of lead in Washington in 1931; the value of its metal output was nearly 84 per cent of the State total.

PIERCE COUNTY

The American Smelting & Refining Co. continued operations at its copper smelter and refinery at Tacoma in 1931, but only a very small part of the smelter receipts originated from mines in Washington. Most of the crude ore and concentrates received at the smelter come from mines in Alaska, Canada, and South America. The chief receipts from Washington consisted of siliceous gold ore from Republic.

SNOHOMISH COUNTY

Index district.—The output of copper ore from the property of the Sunset Copper Co. near Index decreased from 27,809 tons in 1930 to about 5,000 tons in 1931. The mine and mill were operated entirely by lessees in 1931. In spite of the large decrease in output the property produced 86 per cent of the State's copper production.

STEVENS COUNTY

The value of the production of metals in Stevens County was $16,211 in 1931 ($28,475 less than in 1930). The large decrease was due chiefly to the closing of the Bonanza mine and mill at Bossburg and to the decreased output of lead ore from the Electric Point and Gladstone Mountain properties near Northport.

Bossburg district.—The only output of the Bossburg district was a little placer gold from property on the Columbia River. The Bonanza mine and mill were idle the entire year.

Chewelah district.—Lessees shipped from the United Copper mine 2 cars of first-class smelting ore yielding 4 ounces of gold, 8,964 ounces of silver, and 23,776 pounds of copper.

Columbia River district.—Placer gold valued at $292 was recovered from bars on the Columbia River near Kettle Falls, Gerome, and Marcus.

Kettle Falls district.—Three lode mines in the Kettle Falls district produced 38 tons of ore yielding $864 in gold and 146 ounces of silver, valued together at $906, or $23.84 in metals a ton. Nearly all the output was first-class gold ore from the Gold Wreath mine near Meyers Falls.

Northport district.—In 1931 4 lode mines in the Northport district produced 241 tons of ore yielding $34 in gold, 165 ounces of silver, 199 pounds of copper, and 255,573 pounds of lead, valued in all at $9,556, or $39.65 in metals a ton. Placer gold valued at $31 was recovered from the banks of the Columbia River near Northport. In 1930 4 lode mines produced 589 tons of ore yielding metals valued at $25,588. Nearly all the output in 1931 was first-class lead ore of smelting grade from the Gladstone and Electric Point mines, operated by lessees.

Orient district.—The Sunset Gold Mining Co. shipped 1 car of gold ore from the First Thought property near Orient, and the Big Iron Mining Co. shipped more than 1,000 tons of magnetic iron ore to the plant of the Northwest Magnesite Co. at Chewelah for use in the manufacture of dead-burned magnesite.

WHATCOM COUNTY

Mount Baker district (Sumas).—The Westall Leasing Co. continued to operate the Boundary Red Mountain property in Whatcom County, near Sardis, British Columbia, but the ore treated (all by amalgamation) decreased from about 7,000 tons, yielding gold and silver valued at about $71,500, in 1930 to about 1,800 tons, yielding gold and silver valued at about $12,500, in 1931. The property ranked second as a producer of gold in Washington in 1931.

Slate Creek district.—The Azurite Gold Mining Co. did 700 feet of development, mainly in drifting, at its gold-copper property near Twisp. A 30-ton Mace matting furnace was installed in 1931, and a test run of about 80 tons of crude ore was made during November; the matte produced was not marketed in 1931.

WHITMAN COUNTY

Snake River district.—Placer gold valued at $66 was marketed from operations on the Snake River near Almota.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN MONTANA[1]

MINE REPORT)

By T. H. Miller

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SUMMARY

The output of gold, silver, copper, lead, and zinc from Montana mines was valued at $19,575,053 in 1931, a decrease of $13,145,363 (40 percent) from 1930 and 61 percent less than the yearly average ($50,697,412) for the decade 1922 to 1931. Accurate production records for Montana have been kept since 1904, and the value of the output in 1931 was less than in any year during that time except 1921. There were unusually large decreases in production of all five metals. The sharp decline in the prices of silver, copper, lead, and zinc in 1930 forced several of the large producers in Montana to close their properties, and the continued decline in metal prices in 1931 resulted in curtailment of production at the remaining active properties. The Anaconda Copper Mining Co. at Butte was active throughout 1931, but its output of copper ore (the most valuable mine product in Montana) decreased 11 percent from 1930. In 1931 Montana ranked second after Arizona in production of copper and third after Utah and Idaho in production of silver.

An exact valuation of Montana's total metal output by years has never been compiled, but the total value of the gold, silver, copper, lead, and zinc produced from Montana mines from 1862 to 1931 is estimated at $2,794,174,785. According to accurate production data recorded yearly in Mineral Resources of the United States the total value of the mine production of gold, silver, copper, lead, and zinc from 1904 to 1931 has been $1,695,155,086. Details of production follow: Ore, old tailings, etc., 136,249,021 short tons; gold, $77,638,027; silver, 335,993,311 fine ounces; copper, 6,984,869,604 pounds; lead, 559,493,050 pounds; and zinc, 2,690,837,362 pounds.

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[1] Work on manuscript completed October 1932.

[2] The assistance of Paul Luff and LaRu Shepherd, of the Bureau of Mines, is appreciated.

Silver Bow County, which includes the Butte or Summit Valley district, continued to produce most of the silver and copper and in 1931 produced one fourth of the gold; most of the lead in 1931 came from one property in Sanders County; and nearly all the zinc came from current slag from the lead smelter at East Helena. The total value of the metal output of Silver Bow County in 1931 was more than 92 percent of the total value for the State.

Published company reports show that the Anaconda Copper Mining Co. paid $12,224,517 in dividends in 1931 (including a dividend of $5,543,860 declared in December 1930 and paid in February 1931), part of which was paid from receipts from operations in other States. The East Butte Copper Mining Co. was dissolved early in 1931, and the company paid a liquidation dividend early in the year amounting to more than $800,000. No complete record of dividends paid by mining companies in Montana has ever been kept, but a total of $465,545,495 is estimated to have been paid to the end of 1931.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–31

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064	1930	$0.385	$0.130	$0.050	$0.048
1928	.585	.144	.058	.061	1931	.290	.091	.037	.038
1929	.533	.176	.063	.066					

Mine production of gold, silver, copper, lead, and zinc in Montana, 1927–31, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1927	247	60	4,222,607	53,541.25	$1,106,796	11,200,077	$6,350,444
1928	236	43	4,344,279	58,196.09	1,203,020	10,853,276	6,349,166
1929	212	40	4,723,445	54,758.03	1,131,949	12,716,977	6,778,149
1930	193	73	2,686,669	43,489.17	899,001	7,052,889	2,715,362
1931	243	118	2,085,683	40,112.16	829,192	3,829,837	1,110,653

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1927	223,492,639	$29,277,536	35,898,315	$2,261,594	160,461,803	$10,269,555	$49,265,925
1928	248,262,027	35,749,732	33,759,644	1,958,059	165,660,189	10,105,272	55,365,249
1929	297,725,973	52,399,771	39,213,707	2,470,464	136,351,734	8,999,214	71,779,547
1930	196,187,523	25,504,378	21,306,044	1,065,302	52,841,108	2,536,373	32,720,416
1931	184,555,735	16,794,572	8,860,186	327,827	13,494,986	512,809	19,575,053

Gold and silver produced at placer mines in Montana, 1927–31

Year	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
1927	1,079.97	$22,325	197	$112
1928	865.14	17,884	149	87
1929	596.66	12,334	71	38
1930	720.74	$14,899	86	$33
1931	1,907.86	39,439	233	68

GOLD

The production of gold in Montana in 1931 was valued at $829,192, the smallest since detailed records were started in 1904 and much less than the annual average ($1,355,665) for the decade 1922 to 1931 The decrease of nearly 8 percent from production in 1930 resulted chiefly from marked curtailment in output of copper ore from the Liberty Montana mine near Jefferson Island in Madison County and dry gold ore from the Spring Hill property near Helena in Lewis and Clark County. There was also a large decrease in production of gold from mines at Butte in Silver Bow County, chiefly from the property of the Anaconda Copper Mining Co. About half of the gold produced in Montana in recent years prior to 1931 has come from copper ore, but in 1931 more than 61 percent of the total came from dry gold ore, old tailings, etc., and 32 percent from copper ore. There was an increase of nearly 42 percent in production of gold from siliceous gold ore, old tailings, etc., chiefly as a result of the large production of gold from the property of the I. B. Mining Co. at Bannack, Beaverhead County; the August mine near Landusky, Phillips County; and the Ohio-Keating mine near Radersburg, Broadwater County. The output of gold from copper ore decreased more than 40 percent; there was also a large decrease in gold from lead-zinc ore. Amalgamation and cyanidation mills produced more than 16 percent of the total gold, yielding an average of $5.42 in gold and 13 cents in silver to the ton of ore, old tailings, etc., treated; concentrates of all kinds yielded nearly 49 percent of the total gold; crude ore, old tailings, etc., shipped to smelters yielded 30 percent; and placers yielded nearly 5 percent. There was a decided increase in gold produced by amalgamation and cyanidation (especially cyanidation), from crude ore smelted, and from placer mines, but the marked decrease in gold produced in concentration mills more than offset the increases.

Three properties—the Anaconda group at Butte, the Spring Hill mine near Helena, and the I. B. property near Bannack—produced more than 53 percent of the total gold from Montana in 1931; other large producers were the Liberty Montana, August, and Ohio-Keating properties.

SILVER

The output of silver in Montana in 1931 was 3,829,837 ounces, valued at $1,110,653, compared with 7,052,889 ounces, valued at $2,715,362, in 1930, a decrease of 59 percent in value. The 1931 output was the smallest since detailed records were started in 1904 and more than 65 percent less than the yearly average (11,071,865 ounces) for the decade 1922 to 1931. The unusually large decrease in silver output in 1931 resulted from the closing in 1930 of all the large producers except the Anaconda Copper Mining Co. The largest decreases in silver output were in lead-zinc ore from mines at Monarch, Philipsburg, and Butte, in copper ore from mines at Butte, in silver ore from a mine in Flathead County, and in zinc ore from a mine at Butte. The decrease in silver from copper ore, zinc ore, and lead-zinc ore from mines in Silver Bow County accounted for 48 percent of the total decrease. Ninety-seven percent of the total output of silver was obtained from copper ore and old tailings. Silver Bow County, chiefly the Butte district, produced more than 96 percent of the total silver; nearly all of it came from the copper property of the Anaconda Copper Mining Co. Copper concentrates yielded nearly 93 percent of the silver and crude copper ore smelted 4 percent.

The Anaconda Copper Mining Co. was the only large silver producer in Montana in 1931. The Block P property of the St. Joseph Lead Co. near Monarch, Judith Basin County, the Flathead mine of the Anaconda Copper Mining Co. near Kila, Flathead County, and the Butte & Superior property at Butte, Silver Bow County, all large silver producers in 1930, were idle in 1931. The Trout mine near Philipsburg, Granite County, also a large producer of silver in 1930, mined only manganese ore in 1931.

COPPER

The production of copper in Montana in 1931 was 184,555,735 pounds, valued at $16,794,572, compared with 196,187,523 pounds, valued at $25,504,378, in 1930, a decrease of 6 percent in quantity and 34 percent in value compared with 1930 and 38 percent in quantity and 68 percent in value compared with 1929. The output was less in 1931 than in any year since 1922 and 20 percent less than the annual average (231,353,937 pounds) for the decade 1922 to 1931. The decrease was due to the drop in average sale price of copper, from 13 cents a pound in 1930 to 9.1 cents in 1931, which caused the large copper producers at Butte to curtail their output of ore. All but 193,866 pounds of the copper output came from Silver Bow County, which includes the Butte district. Copper ore, old tailings, etc., yielded 99.96 percent of the total copper. Concentrates yielded 91 percent of the copper and crude ore of all kinds shipped to smelters 4 percent; the remainder (5 percent) was saved chiefly from precipitates. Nearly all (67,289 tons) of the copper ore of smelting grade was sulphide; it yielded an average of 5.25 percent copper. Old tailings and miscellaneous material smelted and copper precipitates from mine waters yielded 9,393,798 pounds of copper.

More than 99 percent of the total copper produced in Montana in 1931 came from mines of the Anaconda Copper Mining Co., including various old tailings dumps. The North Butte Mining Co., a large producer of copper in 1930, suspended production early in 1931, and the East Butte Copper Mining Co., a large producer of copper from 1909 to 1930, discontinued operations entirely.

LEAD

The production of lead in Montana in 1931 was 8,860,186 pounds, a decrease of 12,445,858 pounds (more than 58 percent) from 1930. The output in 1931 was the smallest in any year since 1912 and nearly 73 percent less than the annual average (32,406,384 pounds) for the decade 1922 to 1931. The unusually large decrease resulted chiefly from inactivity at the Block P property of the St. Joseph Lead Co. near Monarch, Judith Basin County, the largest producer of lead in Montana in 1930, and from idleness at the Emma and Butte & Superior properties at Butte, Silver Bow County. Low metal prices caused nearly all the large producers of lead ore and lead-zinc ore in Montana to close their properties in 1930. The output of lead from Judith Basin County decreased more than 9,000,000 pounds from 1930 to 1931 and that from Silver Bow County more than 5,000,000 pounds. However, the marked increase of more than 4,000,000 pounds in lead output from the Jack Waite property in Sanders County prevented a much larger decrease in the total lead output of the State. Lead-zinc ore yielded 51 percent (66 percent in 1930) of the lead and lead ore 34 percent; nearly all the remainder came from the treatment of current slag from the lead smelter at East Helena. Concentrates yielded nearly 51 percent of the total lead, crude ore of all kinds shipped to smelters nearly 35 percent, and slag 14 percent. Nearly 79 percent of the lead produced in Montana in 1931 came from crude lead ore of smelting grade and lead-zinc ore of milling grade from the property of the Jack Waite Mining Co. in Sanders County. For the first time since 1904 no lead was produced from mines in Silver Bow County.

ZINC

The production of zinc in Montana in 1931 was 13,494,986 pounds, valued at $512,809, compared with 52,841,108 pounds, valued at $2,536,373, in 1930, a decrease of 74 percent in quantity and 80 percent in value. The output in 1931 was the smallest since 1909 and nearly 89 percent less than the annual average (118,053,368 pounds) for the decade 1922 to 1931. The average sale price of lead and zinc declined to such a low level during the last quarter of 1930 that all the large producers of lead-zinc ore at Butte (Silver Bow County), Monarch (Judith Basin County), and Philipsburg (Granite County) were forced to close their properties. The Butte & Superior Mining Co., the largest producer of zinc in Montana from 1922 to 1930, inclusive, was idle in 1931 as a result of the exhaustion of commercial ore reserves. In consequence of these unusual conditions no zinc or lead was produced from mines in Silver Bow County in 1931. In past years the mines at Butte, Silver Bow County, have produced 50 to 75 percent of the State's total output of zinc, but in 1931 more than 95 percent of the total zinc came from current slag re-treated in the fuming plant of the Anaconda Copper Mining Co. at East Helena, Lewis and Clark County, and nearly all the remainder from lead-zinc ore from the Jack Waite mine in Sanders County. The electrolytic zinc plants at Great Falls and Anaconda were operated at a greatly reduced rate on custom zinc products from various States. The Timber Butte custom mill at Butte and the custom milling plant at Anaconda were idle throughout the year.

The following tables show the relative importance of Silver Bow County or the Butte district.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1931, by counties, in terms of recovered metals

County	Gold					Silver (lode and placer)	
	Lode		Placer		Total value		
	Fine ounces	Value	Fine ounces	Value		Fine ounces	Value
Beaverhead	4,114.10	$85,046	9.09	$188	$85,234	18,220	$5,284
Broadwater	3,158.45	65,291	182.09	3,764	69,055	8,637	2,505
Carbon	11.08	229	----------	--------	229	----------	--------
Cascade	103.23	2,134	----------	--------	2,134	12,481	3,619
Deerlodge	329.68	6,815	1.83	38	6,853	1,300	377
Fergus	611.02	12,631	----------	--------	12,631	813	236
Flathead	2.32	48	----------	--------	48	2,398	695
Granite	349.22	7,219	108.84	2,250	9,469	5,531	1,604
Jefferson	291.70	6,030	13.89	287	6,317	2,979	864
Judith Basin	1.11	23	.68	14	37	835	242
Lewis and Clark	8,621.05	178,213	211.69	4,376	182,589	13,206	3,830
Lincoln	22.50	465	58.24	1,204	1,669	105	30
Madison	7,371.58	152,384	520.22	10,754	163,138	26,280	7,621
Meagher	27.28	564	39.04	807	1,371	16	5
Mineral	36.19	748	267.75	5,535	6,283	16	5
Missoula	----------	----------	51.57	1,066	1,066	3	1
Park	117.12	2,421	50.60	1,046	3,467	24	7
Phillips	2,656.22	54,909	3.97	82	54,991	1,152	334
Powell	213.33	4,410	373.80	7,727	12,137	1,906	553
Ravalli	----------	----------	4.64	96	96	----------	--------
Sanders	162.93	3,368	----------	--------	3,368	35,193	10,206
Silver Bow	10,004.19	206,805	6.24	129	206,934	3,698,742	1,072,635
Stillwater	----------	----------	3.68	76	76	----------	--------
	38,204.30	789,753	1,907.86	39,439	829,192	3,829,837	1,110,653
Total, 1930	42,768.43	884,102	720.74	14,899	899,001	7,052,889	2,715,362

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaverhead	2,585	$235	28,808	$1,066	----------	----------	$91,819
Broadwater	7,025	639	182,671	6,759	73,800	$2,804	81,762
Carbon	----------	----------	143	5	----------	----------	234
Cascade	5,839	531	64,431	2,384	----------	----------	8,668
Deerlodge	644	59	----------	----------	----------	----------	7,289
Fergus	225	20	----------	----------	----------	----------	12,887
Flathead	2,765	252	138	5	----------	----------	1,000
Granite	4,345	395	20,660	764	----------	----------	12,232
Jefferson	2,985	272	48,852	1,808	----------	----------	9,261
Judith Basin	2,612	238	44,568	1,649	----------	----------	2,166
Lewis and Clark	5,280	481	1,298,885	48,059	12,875,845	489,282	724,241
Lincoln	29	3	7,107	263	----------	----------	1,965
Madison	94,934	8,639	184,324	6,820	----------	----------	186,218
Meagher	192	17	----------	----------	----------	----------	1,393
Mineral	----------	----------	----------	----------	----------	----------	6,288
Missoula	----------	----------	----------	----------	----------	----------	1,067
Park	----------	----------	----------	----------	----------	----------	3,474
Phillips	----------	----------	----------	----------	----------	----------	55,325
Powell	602	55	807	30	----------	----------	12,775
Ravalli	----------	----------	----------	----------	----------	----------	96
Sanders	63,804	5,806	6,978,792	258,215	545,341	20,723	298,318
Silver Bow	184,361,869	16,776,930	----------	----------	----------	----------	18,056,499
Stillwater	----------	----------	----------	----------	----------	----------	76
	184,555,735	16,794,572	8,860,186	327,827	13,494,986	512,809	19,575,053
Total, 1930	196,187,523	25,504,378	21,306,044	1,065,302	52,841,108	2,536,373	32,720,416

Ore, old tailings, etc., sold or treated and lode mines producing in Montana, 1930 and 1931, by counties

County	Ore, old tailings, etc. (short tons)		Lode mines producing	
	1930	1931	1930	1931
Beaverhead	257	12,552	5	10
Broadwater	828	8,315	28	33
Carbon		17		1
Cascade	355	126	1	5
Deerlodge	275	301	6	7
Fergus	1	875	1	3
Flathead	9,712	17	1	3
Granite	19,986	459	9	14
Jefferson	11,137	434	20	25
Judith Basin	82,552	74	3	2
Lewis and Clark	155,323	122,609	22	27
Lincoln	1,864	123	4	4
Madison	37,864	18,872	52	81
Meagher		28		3
Mineral	360	83	2	1
Missoula	94		2	
Park	2	70	1	1
Phillips	44	215	4	1
Powell	106	327	10	13
Sanders	14,051	50,838	3	3
Silver Bow	2,351,836	1,869,348	18	6
Stillwater	22		1	
	2,686,669	2,085,683	193	243

Gold and silver produced at placer mines in Montana in 1931, by counties

County	Mines		Gold	Silver (fine ounces)	Total value
	Drift	Hydraulic and sluicing			
Beaverhead		3	$188		$188
Broadwater	3	8	3,764	29	3,772
Deerlodge		1	38		38
Granite	1	13	2,250	12	2,253
Jefferson		5	287		287
Judith Basin		1	14		14
Lewis and Clark	3	11	4,376	24	4,383
Lincoln		3	1,204	4	1,205
Madison		21	10,754	90	10,780
Meagher		6	807	5	809
Mineral	2	11	5,535	8	5,538
Missoula		7	$1,066	3	$1,067
Park	1	3	1,046	8	1,048
Phillips		1	82		82
Powell		9	7,727	47	7,741
Ravalli		2	96		96
Silver Bow		2	129	3	130
Stillwater		1	76		76
	10	108	39,439	233	39,507
Total, 1930	9	64	14,899	86	14,932

MINING INDUSTRY

Continuation of abnormal metal-marketing conditions resulted in the closing of many large producers during the latter part of 1930 and of other producers during 1931. The properties that remained active in 1931 curtailed their output to such an extent that the total value of the mine output of metals was only slightly greater in 1931 than in 1921 when the copper-mining industry was virtually at a standstill. The decrease was greatest in Silver Bow County, due not only to curtailment in copper output but also to suspension of mining of lead ore, lead-zinc ore, and zinc ore from all properties at Butte. For the first time since 1904 no lead or zinc ore was produced from Butte mines. The placer output of the State and the quantity of siliceous gold ore produced increased, but these gains were unimportant compared with the sharp decreases in output of copper, lead, and zinc.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Montana in 1931, with content in terms of recovered metals

Source	Mines producing	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	189	[1] 87, 632	24, 650. 64	27, 169	25, 590	7, 522	
Dry gold and silver ore	3	86	152. 30	9, 336	503	67	
Dry silver ore	7	149	9. 54	10, 371	1, 117	2, 021	
Copper ore	10	[2] 1, 878, 757	12, 905. 58	3, 710, 564	[3] 184, 474, 582		
Lead ore	35	3, 031	262. 85	35, 573	14, 392	3, 032, 550	
Zinc ore	1	[4] 65, 000		6, 023		1, 274, 000	12, 875, 845
Copper-lead ore	1	79	2. 62	4, 064	5, 613	55, 682	
Lead-zinc ore	2	50, 949	220. 77	26, 504	33, 938	4, 488, 344	619, 141
Total, lode mines	[5] 243	2, 085, 683	38, 204. 30	3, 829, 604	[3] 184, 555, 735	8, 860, 186	13, 494, 986
Total, placers	118		1, 907. 86	233			
	361	2, 085, 683	40, 112. 16	3, 829, 837	[3] 184, 555, 735	8, 860, 186	13, 494, 986
Total, 1930	266	2, 686, 669	43, 489. 17	7, 052, 889	[6] 196, 187, 523	21, 306, 044	52, 841, 108

[1] Includes 34 tons of old mill clean-up and 2 tons of old slag amalgamated, 800 tons of old tailings cyanided, and 279 tons of old mill clean-up and 607 tons of old tailings sold to a smelter.
[2] Includes 18,613 tons of old tailings sold to a smelter.
[3] Includes 9,092,564 pounds of copper recovered from precipitates.
[4] Current slag fumed.
[5] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[6] Includes 11,465,232 pounds of copper recovered from precipitates.

Value of metals from ore, old tailings, etc., sold or treated in Montana in 1931, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total value
Dry gold ore	87, 632	$509, 574	$7, 879	$2, 329	$278		$520, 060
Dry gold and silver ore	86	3, 148	2, 707	46	3		5, 904
Dry silver ore	149	197	3, 008	101	75		3, 381
Copper ore	1, 878, 757	266, 782	1, 076, 063	[1] 16, 787, 187			18, 130, 032
Lead ore	3, 031	5, 434	10, 316	1, 310	112, 204		129, 264
Zinc ore	65, 000		1, 747		47, 138	$489, 282	538, 167
Copper-lead ore	79	54	1, 179	511	2, 060		3, 804
Lead-zinc ore	50, 949	4, 564	7, 686	3, 088	166, 069	23, 527	204, 934
	2, 085, 683	789, 753	1, 110, 585	[1] 16, 794, 572	327, 827	512, 809	19, 535, 546
Total, 1930	2, 686, 669	884, 102	2, 715, 329	[2] 25, 504, 378	1, 065, 302	2, 536, 373	32, 705, 484

[1] Includes value of 9,092,564 pounds of copper recovered from precipitates.
[2] Includes value of 11,465,232 pounds of copper recovered from precipitates.

GOLD ORE

Gold ore, old tailings, etc., were reported from 189 mines and dumps in Montana in 1931 compared with 106 in 1930. This material, the output of which increased 12 percent, yielded on the average $5.81 in gold and 0.31 ounce of silver to the ton and a little copper and lead and was valued at $5.93 in recovered metals a ton. The Spring Hill mine near Helena, Lewis and Clark County, produced nearly 63 percent of the total gold ore, etc.; its output, however, was 23 percent less than in 1930. The increase in total output of gold ore, etc., was due chiefly to the large production from the property of the I. B. Mining Co. near Bannack, Beaverhead County; the increase from the Ohio-Keating mine near Radersburg, Broadwater County; and the increase from several mines in Madison County.

GOLD AND SILVER ORE

Gold and silver ore (86 tons) was reported in 1931 from three mines—one near Neihart, Cascade County; one near Garnet, Granite County; and one near Deer Lodge, Powell County. This ore yielded on the average $36.60 in gold and 108.56 ounces of silver to the ton and a little copper and lead and was valued at $68.65 in recovered metals a ton.

SILVER ORE

Siliceous silver ore (149 tons) was produced by seven mines in Montana in 1931 and yielded on the average $1.32 in gold and 69.60 ounces of silver to the ton and a little copper and lead; it was valued at $22.69 in recovered metals a ton. The output decreased more than 16,500 tons from 1930 as a result of inactivity at the Granite Bimetallic dump at Philipsburg, Granite County, and the Flathead mine near Kila, Flathead County, and most of it came from three properties—near Butte, Southern Cross, and Dillon.

COPPER ORE

Copper ore and old tailings, the output of which decreased more than 360,000 tons compared with 1930, were reported from 10 mines and dumps in Montana in 1931 and represented 90 percent of the total output of ore, etc., of the State. The total value of the metals recovered from copper ore and old tailings represented more than 92 percent of the total value of the metal output of the State, exclusive of the value of copper from mine-water precipitates. The average yield from copper ore and old tailings was 14 cents in gold and 1.98 ounces of silver to the ton and 4.67 percent (93.4 pounds to the ton) of copper, and the average value in recovered metals a ton was $9.21. Nearly all the copper ore was mined at Butte—largely from the Anaconda property—and most of it was milling ore. The North Butte Mining Co. at Butte, and the Liberty Montana Mines Co., operating the Mammoth property near Jefferson Island, Madison County, also produced copper ore.

LEAD ORE

The output of lead ore reported from 35 mines in Montana in 1931 was 3,031 tons compared with 23,642 tons of ore and old slag from 49 mines and 1 slag dump in 1930. The average yield from lead ore in 1931 was $1.79 in gold and 11.74 ounces of silver to the ton, 0.24 percent copper, and 50.03 percent lead; the average value in recovered metals a ton was $42.65. There was a general decrease in output of lead ore from mines in nearly all the producing counties as a result of the continued drop in price of lead and silver. There was also an apparent decrease of about 12,000 tons in output of lead ore due to a change in milling methods at the Jack Waite property in Sanders County. In 1930 at the old mill the company made no attempt to recover the zinc, but in 1931 a new 500-ton flotation plant was placed in operation and recovered both lead and zinc; the ore was consequently classed as lead-zinc ore in 1931 instead of lead ore as in 1930. Besides the lead-zinc ore milled the company shipped more than 2,000 tons of first-class lead ore to a smelter.

ZINC ORE

The only zinc material produced in 1931 was current slag from the lead smelter at East Helena; it was treated in the fuming plant of the Anaconda Copper Mining Co. This material, valuable chiefly for its zinc content, averaged $8.28 in recovered metals a ton. The output of zinc ore and slag in 1930 was 159,288 tons; about half of it was zinc ore from the property of the Butte & Superior Mining Co., idle in 1931 as a result of the exhaustion of commercial ore.

COPPER-LEAD ORE

A small quantity of copper-lead ore of smelting grade was produced by lessees from the Silver Dyke property at Neihart, Cascade County. The ore contained chiefly lead, silver, and copper; it averaged $48.15 in recovered metals a ton.

LEAD-ZINC ORE

The output of lead-zinc ore in Montana was 50,949 tons from two mines in 1931 compared with 168,864 tons from 20 mines in 1930. The average yield from lead-zinc ore in 1931 was 9 cents in gold and 0.52 ounce of silver to the ton, 0.03 percent copper, 4.40 percent lead, and 0.61 percent zinc; the average value in recovered metals a ton was $4.02. The unusually large decrease (117,915 tons) in output was due to the closing in 1930 of the chief producers of lead-zinc ore as a result of low metal prices. The Block P mine of the St. Joseph Lead Co. near Monarch, Judith Basin County, the largest producer of lead-zinc ore in Montana in 1930, was idle in 1931, as were also the Emma mine (except for manganese ore) at Butte, the mines near Philipsburg, Granite County, and the mines near Basin, Jefferson County. The only large producer of lead-zinc ore in Montana in 1931 was the Jack Waite property in Sanders County.

Ore, old tailings, etc., sold or treated in Montana in 1931, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaverhead	12,413	4,047.53	9,983	593	101	
Broadwater	[1] 5,896	2,988.67	1,601	5,249	1,688	
Carbon	17	11.08			143	
Deerlodge	241	326.50	46	420		
Fergus	868	610.03	302	22		
Granite	[2] 336	298.54	696	1,345		
Jefferson	[3] 233	265.14	311	1,088	250	
Lewis and Clark	[4] 57,483	8,604.36	4,903	4,452	698	
Lincoln	102	22.50	5			
Madison	[5] 9,357	4,461.79	7,926	11,712	4,581	
Meagher	28	27.28	11	192		
Mineral	83	36.19	8			
Park	70	117.12	16			
Phillips	215	2,656.22	1,152			
Powell	272	151.72	146	212	61	
Silver Bow	18	25.97	63	305		
	87,632	24,650.64	27,169	25,590	7,522	
Total, 1930	78,376	17,396.01	10,967	13,302	3,361	

[1] Includes 605 tons of old tailings sold to a smelter.

[2] Includes 1 ton of clean-up amalgamated.

[3] Includes 1 ton of clean-up amalgamated and 3 tons of clean-up sold to a smelter.

[4] Includes 30 tons of clean-up amalgamated, 800 tons of old tailings cyanided, and 2 tons of old tailings and 276 tons of clean-up sold to a smelter.

[5] Includes 2 tons of old slag and 2 tons of clean-up amalgamated.

Ore, old tailings, etc., sold or treated in Montana in 1931, by counties, with content in terms of recovered metals—Continued

DRY GOLD AND SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cascade	24	100.31	7,419	175	67	
Granite	15	4.05	262	36		
Powell	47	47.94	1,655	292		
	86	152.30	9,336	503	67	
Total, 1930	371	90.00	6,047	142		

DRY SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Beaverhead	36	1.68	5,824	546	1,883	
Deerlodge	60	3.18	1,254	224		
Fergus	7	.99	511	203		
Flathead	4	.74	2,382		138	
Silver Bow	42	2.95	400	144		
	149	9.54	10,371	1,117	2,021	
Total, 1930	16,801	266.32	640,425	4,952	230	

COPPER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Flathead	13	1.58	16	2,765		
Granite	39	38.53	82	2,826		
Jefferson	30	8.28	37	1,401		
Madison	9,270	2,840.89	10,280	83,007		
Powell	1	1.07	1	80		
Sanders	116	39.96	1,872	23,083		
Silver Bow	[6] 1,869,288	9,975.27	3,698,276	[7] 184,361,420		
	1,878,757	12,905.58	3,710,564	[7] 184,474,582		
Total, 1930	2,238,997	21,715.70	4,583,827	[8] 195,308,188		

LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Beaverhead	103	64.89	2,413	1,446	26,824	
Broadwater	109	35.38	1,522	116	66,174	
Cascade	23	.30	998	51	8,682	
Granite	69	8.10	4,479	138	20,660	
Jefferson	171	18.28	2,631	496	48,602	
Judith Basin	74	1.11	835	2,612	44,568	
Lewis and Clark	126	16.69	2,256	828	24,187	
Lincoln	21		96	29	7,107	
Madison	245	68.90	7,984	215	179,743	
Powell	7	12.60	57	18	746	
Sanders	2,083	36.60	12,302	8,443	2,605,257	
	3,031	262.85	35,573	14,392	3,032,550	
Total, 1930	23,642	788.58	91,635	48,742	4,198,956	85,134

LEAD-ZINC ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Broadwater	2,310	134.40	5,485	1,660	114,809	73,800
Sanders	48,639	86.37	21,019	32,278	4,373,535	545,341
	50,949	220.77	26,504	33,938	4,488,344	619,141
Total, 1930	168,864	2,154.06	1,261,859	533,715	14,146,684	20,944,118

[6] Includes 18,613 tons of old tailings sold to a smelter.
[7] Includes 9,092,564 pounds of copper recovered from precipitate
[8] Includes 11,465,232 pounds of copper recovered from precipitat

Zinc products (as marketed from Montana mines and mills) sold to smelters and electrolytic plants in 1931

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of concentrates	Recovered zinc
		Short tons	*Pounds*	*Percent*	*Pounds*
Zinc concentrates	Broadwater and Sanders	712	671,558	47.16	619,141
		712	[1] 671,558	47.16	[1] 619,141
Total, 1930		38,801	[1] 42,546,033	54.83	[1] 38,944,858

[1] Exclusive of zinc recovered from the treatment of current slag at East Helena.

METALLURGIC INDUSTRY

No important new construction work was done at metallurgical plants in Montana during 1931. Many of the larger concentration plants were idle, including the plant of the St. Joseph Lead Co. at Hughesville and the Timber Butte and Anaconda custom flotation plants of the Anaconda Copper Mining Co. for lead-zinc ore at Butte and Anaconda. The large copper flotation plant at Anaconda was operated continuously during the year but at a lower rate than in 1930. The electrolytic zinc plant at Anaconda was closed in June and the Great Falls plant operated at a reduced rate the entire year. The copper smelter at Anaconda was operated regularly, but the lead smelter at East Helena was closed for several months during the summer.

Forty-four milling plants of various kinds were active in Montana in 1931, although many of them ran for short periods only. They include 17 plants using the amalgamation process, 12 using amalgamation and concentration, 4 using cyanidation, 5 using table concentration, 1 using flotation equipment after table concentration, and 5 using straight flotation. There were also 2 electrolytic zinc-leaching plants, 1 copper-precipitating plant at Butte that recovers copper from mine water, and 1 zinc fuming plant.

Of the 25,192 tons of ore, etc., treated at gold and silver mills, 8,488 tons of ore and 36 tons of old clean-up material and old slag were treated by amalgamation, with an average recovery per ton of $4.33 in gold and 0.09 ounce of silver, and 15,868 tons of ore and 800 tons of old tailings were treated by cyanidation, with an average recovery per ton of $5.97 in gold and 0.65 ounce of silver. The quantity of ore treated by amalgamation in 1931 was nearly double that in 1930; the quantity of ore and old tailings treated by cyanidation increased from 630 to 16,668 tons. The marked increase in quantity of material treated by cyanidation was due chiefly to the large output of gold ore from the property of the I. B. Mining Co., near Bannack, Beaverhead County, and the Ohio-Keating mine near Radersburg, Broadwater County.

Concentrating mills in Montana handled 91 percent of the total material mined or treated, and more than 94 percent of the total material concentrated was copper ore. The resulting concentrates, together with those from gold and silver mills, averaged $46.42 in recovered metals a ton compared with $59.12 in 1930; the quantity of each class of concentrates produced decreased considerably, and the total was 25 percent less than in 1930. The total value of metals recovered from all concentrates was 86 percent of the total metal value for the State, and the value from copper concentrates was 98 percent of the total value from all concentrates.

For 1931, as for 1929 and 1930, exact figures for the metal content of the mill feed were obtained from concentration mills treating Montana ore. These figures are presented in the accompanying tables and are separated by classes of ore treated, methods of concentration, and classes of concentrates produced.

Mine production of metals from gold and silver mills in Montana in 1931, by counties, in terms of recovered metals

County	Ore, old tailings, etc., treated (dry weight)		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings, etc.	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Beaverhead	12,328	-----	17.18	1	3,929.57	9,602
Broadwater	2,877	-----	172.04	53	198.07	19
Deerlodge	1	-----	4.49	1	-----	-----
Fergus	865	-----	-----	-----	603.40	260
Granite	30	[1] 1	22.84	8	-----	-----
Jefferson	40	[1] 1	100.96	43	-----	-----
Lewis and Clark	1,459	[2] 830	367.34	262	86.30	1,029
Lincoln	102	-----	18.00	3	-----	-----
Madison	6,365	[3] 4	872.31	354	-----	-----
Meagher	1	-----	1.60	-----	-----	-----
Park	70	-----	117.12	16	-----	-----
Powell	217	-----	91.88	29	-----	-----
Silver Bow	1	-----	1.55	3	-----	-----
	24,356	836	1,787.31	773	4,817.34	10,910
Total, 1930	4,931	553	1,259.73	619	75.70	1,088

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Beaverhead	2	4.00	5	57	-----
Broadwater	1	2.80	11	-----	-----
Jefferson	2	6.73	11	-----	79
Lewis and Clark	20	63.86	307	-----	312
Lincoln	1	4.50	2	-----	-----
Madison	139	444.35	952	463	1,193
Powell	5	20.21	72	32	-----
	170	546.45	1,360	552	1,584
Total, 1930	127	437.30	506	206	659

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[1] Clean-up amalgamated.

[2] Includes 30 tons of clean-up amalgamated and 800 tons of old tailings cyanided.

[3] Includes 2 tons of clean-up and 2 tons of old slag amalgamated.

Montana ore[1] *concentrated in 1931, by classes of ore, methods of concentration, and classes of concentrates*

Class of ore concentrated	Method of concentration	Ore concentrated	Gross content of mill feed				
			Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Siliceous gold	Flotation	54,826	8,739.22	1,653	6,400		
Copper sulphide	do	1,783,457	10,555.61	3,752,394	183,196,700		
Lead-zinc sulphide [2]	do	[2] 50,949	288.51	30,116	74,120	5,135,926	1,425,391
		1,889,232	19,583.34	3,784,163	183,277,220	5,135,926	1,425,391
Copper sulphide	Gravity and flotation	9,270	3,125.00	11,590	108,600		
Siliceous gold	Gravity	225	39.10	43	280		
Lead sulphide	do	50	1.00	820	66	17,200	
		[2] 275	40.10	863	346	17,200	
Total		[3] 1,898,777	22,748.44	3,796,616	183,386,166	5,153,126	1,425,391

Class of ore concentrated	Method of concentration	Concentrates produced		Gross content of concentrates				
		Class	Quantity	Gold	Silver	Copper	Lead	Zinc
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Siliceous gold	Flotation	Siliceous gold	2,313	6,656.21	1,259	3,781		
Copper sulphide	do	Copper sulphide	356,822	9,223.27	3,540,521	175,668,775		
Lead-zinc sulphide[4]	do	Lead sulphide	3,594	162.91	24,542	35,373	4,592,913	
		Zinc sulphide	712	57.86	1,962	12,733	81,239	671,558
			[4] 4,306	220.77	26,504	48,106	4,674,152	671,558
			[4] 363,441	16,100.25	3,568,284	175,720,662	4,674,152	671,558
Copper sulphide	Gravity and flotation	Copper sulphide	890	2,840.89	10,280	87,376		
Siliceous gold	Gravity	Siliceous gold	31	31.26	34	221		
Lead sulphide	do	Lead sulphide	11	.64	664	53	14,105	
			[4] 42	31.90	698	274	14,105	
Total			[5] 364,373	18,973.04	3,579,262	175,808,312	4,688,257	671,558

[1] No old tailings reconcentrated in Montana in 1931.

[2] 2,310 tons of lead-zinc ore treated by gravity concentration included under flotation.

[3] Figures do not include ore treated at gold and silver mills.

[4] Concentrates from 2,310 tons of lead-zinc ore treated by gravity concentration included under flotation.

[5] Figures do not include concentrates from ore treated at gold and silver mills.

Mine production of metals from concentrating mills in Montana in 1931, by counties, in terms of recovered metals

County	Ore and old tailings treated (dry weight)		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Broadwater	2, 385		305	152. 17	5, 491	1, 827	114, 809	73, 800
Lewis and Clark	54, 646		2, 306	6, 567. 76	1, 193	2, 800		
Madison	9, 575		913	2, 937. 27	11, 037	83, 309	13, 541	
Mineral	75		1	6. 20	1			
Sanders	48, 639		4, 026	86. 37	21, 019	32, 278	4, 373, 535	545, 341
Silver Bow	1, 783, 457		356, 822	9, 223. 27	3, 540, 521	167, 913, 781		
	1, 898, 777		364, 373	18, 973. 04	3, 579, 262	168, 033, 995	4, 501, 885	619, 141
Total, 1930	2, 485, 121	7, 000	486, 588	37, 138. 16	5, 589, 844	177, 391, 352	18, 323, 822	38, 944, 858

Gross metal content of Montana concentrates produced in 1931, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	2, 498	7, 187. 36	2, 086	4, 633	83	
Copper	357, 712	12, 064. 16	3, 550, 801	175, 756, 151		
Lead	3, 621	210. 11	25, 773	35, 465	4, 608, 602	
Zinc	712	57. 86	1, 962	12, 733	81, 239	671, 558
	364, 543	19, 519. 49	3, 580, 622	175, 808, 982	4, 689, 924	671, 558
Total, 1930	486, 715	37, 619. 71	5, 617, 847	184, 865, 422	19, 225, 800	42, 546, 033

Mine production of metals from Montana concentrates in 1931, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaverhead	2	4. 00	5	57		
Broadwater	306	154. 97	5, 502	1, 827	114, 809	73, 800
Jefferson	2	6. 73	11		79	
Lewis and Clark	2, 326	6, 631. 62	1, 500	2, 800	312	
Lincoln	1	4. 50	2			
Madison	1, 052	3, 381. 62	11, 989	83, 772	14, 734	
Mineral	1	6. 20	1			
Powell	5	20. 21	72	32		
Sanders	4, 026	86. 37	21, 019	32, 278	4, 373, 535	545, 341
Silver Bow	356, 822	9, 223. 27	3, 540, 521	167, 913, 781		
	364, 543	19, 519. 49	3, 580, 622	168, 034, 547	4, 503, 469	619, 141
Total, 1930	486, 715	37, 575. 46	5, 590, 350	177, 391, 558	18, 324, 481	38, 944, 858

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	2, 498	7, 187. 36	2, 086	3, 756	79	
Copper	357, 712	12, 064. 16	3, 550, 801	167, 996, 788		
Lead	3, 621	210. 11	25, 773	25, 010	4, 423, 127	
Zinc	712	57. 86	1, 962	8, 993	80, 263	619, 141

Crude ore directly smelted in 1931 amounted to nearly 4 percent of the total ore, old tailings, etc., mined or treated; it averaged $13.57 in recovered metals a ton. The total quantity of crude ore smelted was practically the same in 1931 as in 1930. The quantity of siliceous silver ore smelted decreased decidedly, but the increase in siliceous gold ore and copper ore smelted virtually offset this decrease. Most (87 percent) of the first-class material was sulphide copper ore, and nearly all of it was from the Anaconda property at Butte.

Gross metal content of Montana crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Quantity (dry weight)	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous	6,738	9,656.98	31,906	23,100	8,322
Copper	67,417	776.42	149,303	7,420,133	
Lead	2,981	262.21	34,909	19,880	3,147,531
Copper-lead	79	2.62	4,064	7,017	58,612
	77,215	10,698.23	220,182	7,470,130	3,214,465
Total, 1930	77,674	3,621.68	1,410,149	6,512,353	1,776,125

Mine production of metals from Montana crude ore shipped to smelters in 1931, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Beaverhead	224	163.35	8,612	2,528	28,808
Broadwater	2,448	2,386.61	2,666	4,123	67,862
Carbon	17	11.08			143
Cascade	126	103.23	12,481	5,839	64,431
Deerlodge	300	325.19	1,299	644	
Fergus	10	7.62	553	225	
Flathead	17	2.32	2,398	2,765	138
Granite	428	326.38	5,511	4,345	20,660
Jefferson	390	180.87	2,922	2,973	48,773
Judith Basin	74	1.11	835	2,612	44,568
Lewis and Clark	396	468.76	4,105	1,730	24,478
Lincoln	21		96	29	7,107
Madison	2,928	3,117.65	13,847	11,162	169,590
Meagher	27	25.68	11	192	
Mineral	8	29.99	7		
Phillips	215	2,656.22	1,152		
Powell	110	101.24	1,758	570	807
Sanders	2,199	76.56	14,174	31,526	2,605,257
Silver Bow	67,277	714.37	147,755	7,056,127	
	77,215	10,698.23	220,182	7,127,390	3,082,622
Total, 1930	77,674	3,621.68	1,410,149	6,243,538	1,695,759

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead
Dry and siliceous	6,738	9,656.98	31,906	21,586	7,931
Copper	67,417	776.42	149,303	7,085,833	
Lead	2,981	262.21	34,909	14,358	3,019,009
Copper-lead	79	2.62	4,064	5,613	55,682

The miscellaneous material, not included in the total ore milled or the first-class ore directly smelted, consisted of old tailings, etc., milled, current slag from the lead smelter fumed at East Helena, and 19,499 tons of old tailings and clean-up material shipped for smelting. The total miscellaneous material, exclusive of old tailings, etc., milled and current slag fumed, yielded 1,381.93 ounces of gold, 11,094 ounces of silver, 301,234 pounds of copper, and 95 pounds of lead; in addition, precipitates from mine water yielded 9,092,564 pounds of copper.

REVIEW BY COUNTIES AND DISTRICTS

Notes usually given under the district reviews in this series of reports have been greatly curtailed in an effort to reduce the size of the chapters for 1931. Details on development, notes from printed reports, and statements comparing the production of the current year with that of past years have been omitted unless of unusual importance. Mention of the production of small quantities of placer gold or small shipments of ore in certain districts has also been omitted.

BEAVERHEAD COUNTY

The value of the production of metals in Beaverhead County increased from $10,338 in 1930 to $91,819 in 1931, due chiefly to activity of the I. B. Mining Co. at the Sleeping Princess group near Bannack.

Argenta district.—Two placers and five lode mines in the Argenta district produced 82 tons of ore, $1,742 in gold, 509 ounces of silver, 348 pounds of copper, and 11,987 pounds of lead, valued in all at $2,365, an increase from a district output of $898 in 1930. The output from lode mines in 1931 was all first-class smelting ore and consisted of oxidized lead ore from the Iron Mountain and Midnight mines and siliceous gold ore from the Sir Walter Scott, Bright Smile, and Oro Fino properties. The placer output, valued at $134, was recovered by sluicing, chiefly at the Pilgrim property near Argenta.

Bannack district.—The I. B. Mining Co. continued operations at the Sleeping Princess group at Bannack and resumed milling operations in April. During the 9 months of operation more than 12,000 tons of gold ore were treated by cyanidation. The company was by far the largest producer in the county, ranked third in output of gold in Montana, and reported 3,120 feet of development during the year. The remainder of the district output consisted of gold ore from the Gold Crown property and a little placer gold from a prospect on Grasshopper Creek.

Big Hole district.—A little gold ore from the North Star mine was treated by amalgamation.

Blue Wing district.—One car of silver ore from the New Departure mine was shipped for smelting.

Bryant district.—One car of lead ore from the Hecla property near Melrose was shipped to Midvale, Utah, for smelting.

BROADWATER COUNTY

The value of the production of metals in Broadwater County increased from $33,302 in 1930 to $81,762 in 1931 as a result of increased output of gold ore from the Ohio-Keating mine near Radersburg.

Backer district (Canton).—Eight placers and three lode mines in the Backer district produced 23 tons of ore, $3,616 in gold, and 72 ounces of silver, valued together at $3,637. The placer output, valued at $2,241, came chiefly from properties in Confederate Gulch, including the Ellis, Grub Stake & Snow Shoe, Diamond City (Consolidated), Shrauger, Smith, and Brand placers. The entire output from lode mines was siliceous gold ore, chiefly from the Blind Mike (Three Sisters) and Slim Jim properties.

Beaver district (*Winston*).—Nine lode mines in the Beaver district produced 3,004 tons of ore and old tailings yielding $10,638 in gold, 6,585 ounces of silver, 2,950 pounds of copper, 127,906 pounds of lead, and 73,800 pounds of zinc, valued in all at $20,352, or $6.77 in metals a ton. The district output in 1930 was valued at $5,952. Most of the output in 1931 was lead-zinc ore from the January group treated in a small gravity concentration plant. One car of gold ore and several hundred tons of old tailings from the Iron Age property were shipped for smelting. Other producers in the district were the Custer (Doane Incline), Joe Dandy, Martha Washington, Midas, Black Tail, Top Notch, and Winter State properties.

Cedar Plains district (*Radersburg*).—One placer and eighteen lode mines in the Cedar Plains district produced 5,265 tons of ore, $52,741 in gold, 1,762 ounces of silver, 4,045 pounds of copper, and 49,804 pounds of lead, valued in all at $55,463, an increase from a district output of $18,647 in 1930. In 1931 the ore yielded on the average $10.52 in metals a ton; the placer output, valued at $62, came from the Radersburg property. The lode output consisted of 2,324 tons of smelting ore, 75 tons of concentrating ore which was reduced to 25 tons of concentrates, and 2,866 tons of gold ore treated chiefly by cyanidation but partly by amalgamation. The Ohio-Keating property operated by the Ohio-Keating Gold Mining Corporation was the largest producer in the district in 1931; the company treated nearly 2,700 tons of gold ore in a 100-ton cyanidation mill and shipped more than 1,600 tons of gold ore to smelters. The property was the largest producer in Broadwater County in 1931 and ranked sixth in production of gold in Montana. Lessees operating the Hard Cash mine near Radersburg shipped more than 400 tons of gold ore to Anaconda for smelting. Other producers of gold ore were the Mighty Monarch, Cyclone, Gold Crown, Gold Queen, Hidden Treasure, Keating, Kahoka, Laura Mae, Ohio, and Pinchback properties. No development was reported at the Joe-Dandy group of the Butte Copper Consolidated Mines Co., formerly the largest producer in the district, and only 2 cars of lead ore were shipped for smelting. Small lots of lead ore were also shipped from the Little Joe and Gopher groups.

Magpie Gulch district.—Various small placer operations in the Magpie Gulch district produced $1,467 in gold and 9 ounces of silver, valued together at $1,469. Nearly all the output came from the Sheriff Patent property.

Park (*Indian Creek, Hassel*) *district* (*Townsend*).—One car of lead ore from the Gold Dust property and test lots of gold ore from the Morning Glory and Only One properties, all west of Townsend, were shipped to East Helena for smelting.

CARBON COUNTY

Clark Fork district.—One car of gold ore from a property in the Clark Fork district near Belfry was shipped to East Helena for smelting.

CASCADE COUNTY

The value of the production of metals in Cascade County was $8,668, a decrease of $4,965 from 1930. Operations were on a curtailed basis at the copper refinery, rod and wire mill, and electrolytic zinc plant of the Anaconda Copper Mining Co. at Black Eagle near Great Falls. The results of operations at the Great Falls and Anaconda plants are given under Silver Bow County, with other notes of the Anaconda Copper Mining Co. (see p. 508).

Montana district (*Neihart*).—Production from the Montana district in 1931 consisted of 1 car of gold and silver ore from the Big Seven group, lead ore from the Alice S. Extension, Florence, and Lizzie properties, and 2 cars of copper-lead ore from the Silver Dyke mine. The entire output in 1931 was first-class ore of smelting grade, as no ore was treated in the large mill of the Silver Dyke Mining Co.

DEERLODGE COUNTY

The value of the production of metals in Deerlodge County increased from $4,062 in 1930 to $7,289 in 1931. Most of the output was gold-bearing iron ore from mines near Southern Cross.

The copper concentrator and copper smelter of the Anaconda Copper Mining Co. at Anaconda were active throughout the year. Copper ore from mines at Butte was treated in the 12,000-ton concentrator, and the concentrates were reduced to blister copper at the rate of about 15,375,000 pounds a month compared with 16,400,000 pounds in 1930 and nearly 25,000,000 pounds in 1929. The 1,750-ton zinc concentrator at Anaconda has been idle since November 1930, and most of the custom zinc material received in 1931 was treated in the electrolytic plant at Great Falls.

Dry Gulch district.—A test lot of gold ore was shipped from the Dark Horse mine, and a little placer bullion was marketed from the Dry Gulch property on Modesty Creek.

Georgetown district (*Southern Cross*).—Four lode mines in the Georgetown district produced 273 tons of ore yielding $6,579 in gold, 647 ounces of silver, and 405 pounds of copper, valued in all at $6,804. The output was all gold-bearing iron ore, chiefly from the Short Shift mine, and was shipped to Anaconda for smelting; other producers near Southern Cross were the Gold Coin, Silver Reef, and Hazel properties.

Oro Fino district.—The Fairview Mining Co. continued operations at the Independence property and marketed test lots of gold ore and a little gold bullion from ore treated by pan amalgamation. One car of silver ore was shipped from the Joker Fraction group by the Banker Leasing Co.

FERGUS COUNTY

Warm Springs district.—Three lode mines in the Warm Springs district produced 875 tons of ore yielding $12,631 in gold, 813 ounces of silver, and 225 pounds of copper, valued in all at $12,887. Nearly all the output was gold ore from the Tailholt mine near Maiden treated by cyanidation. A test lot of gold ore was shipped from the Kentucky mine.

FLATHEAD COUNTY

The Flathead mine of the Anaconda Copper Mining Co. in the Hog Heaven district near Kila, the chief producer in Flathead County in 1929 and the only producer in 1930, was idle in 1931. Test lots of silver ore from the Ole and D & H properties near Kila were shipped to Kellogg, Idaho, for smelting. A little copper ore from the Foolsburg mine in the Star Meadow district near Lupfer was shipped to Anaconda for smelting.

GRANITE COUNTY

The mine output of each of the five metals in Granite County decreased decidedly in 1931, and the value of the metal output decreased from $363,829 in 1930 to $12,232 in 1931; no zinc was produced in 1931. The general decrease was due to the fact that the Trout and Silver Prince mines at Philipsburg produced no lead-zinc ore in 1931.

Alps district.—Oxidized copper ore from the Golconda and Gold Bug properties was shipped to Anaconda for smelting.

Big Spring Creek district.—A little gold from the Boulder placer on Big Spring Creek was shipped to the Denver Mint.

First Chance district (*Garnet*).—Seven placers and six lode mines in the First Chance district produced 219 tons of ore, $4,750 in gold, 443 ounces of silver, and 818 pounds of copper, valued in all at $4,952. The output from lode mines, valued at $3,425, was all first-class ore of smelting grade, chiefly gold ore from the Grant & Hartford, Mountain View, Homestake, Climax, Lady Jane, and Tiger properties. The placer output came chiefly from the Cayuse, Hill Top, Potlatch, and Ten Mile properties.

Flint Creek district (*Philipsburg*).—The Hobo (Old Chief) property was the only producer in the Flint Creek district in 1931. In 1930 3 lode mines and 1 tailings dump produced 12,413 tons of ore and about 7,000 tons of old tailings with a total value in metals of $351,441. The large decrease was due to the fact that no lead-zinc ore was mined at the Trout and Silver Prince properties. In 1931 the output of the district was 2 cars of oxidized lead ore shipped from the Hobo mine to East Helena for smelting. The Trout Mining Co. and the Moorlight Mining Co. continued to operate their manganese-concentration plants in 1931 and treated nearly 15,000 long tons of manganese ore; the former treated ore from its Trout mine, and the latter treated ore from various mines in the district.

Frog Pond Basin district.—Siliceous gold ore from the Miller property near Philipsburg was shipped to Anaconda for smelting.

Moose Lake district.—A test lot of gold ore from the Abe Lincoln property was shipped to Anaconda.

Rose Mountain (*South Gold Creek*) *district.*—A small lot of gold ore from the Rose Mountain property near Goldcreek was shipped to Anaconda.

South Boulder district (*Maxville*).—Two placers and two lode mines in the South Boulder district produced 44 tons of ore and old mill clean-up material, $1,272 in gold, 43 ounces of silver, and 106 pounds of copper, valued in all at $1,295. The output from lode mines, valued at $802, was gold ore from the Royal Gold and Tacoma properties and old mill clean-up material. The Montana-Tonopah and Princeton & Sunset placers were active in 1931.

JEFFERSON COUNTY

The value of the production of metals in Jefferson County was $9,261 compared with $171,687 in 1930. The large decrease was due to inactivity at the Comet and Gray Eagle mines in the Cataract district.

Boulder district.—Several cars of oxidized lead ore from the Ida mine near Boulder were shipped to smelters at East Helena, Mont., and Midvale, Utah.

Cataract district (*Basin*).—One placer and eight lode mines in the Cataract district produced 49 tons of ore and old clean-up material, $2,686 in gold, 76 ounces of silver, and 250 pounds of lead, valued in all at $2,717. In 1930 nine lode mines produced 10,881 tons of ore with a total value in metals of $166,499. The unusually large decrease in district output was due to inactivity at the Comet and Gray Eagle properties, which have been idle since October 1930. The output in 1931 consisted of gold ore amalgamated at the Mantle, Boulder Dump, South Bend, Independence, and Peerless properties, gold ore treated by amalgamation and concentration at the Gray Lead and Rock of Ages properties, and a little gold ore shipped to a smelter from the Jib and Rock of Ages properties.

Elkhorn district.—Three lode mines in the Elkhorn district produced 139 tons of ore yielding $906 in gold, 66 ounces of silver, and 2,363 pounds of copper, valued in all at $1,140. The output consisted of sulphide copper ore from the Copper Queen mine and gold ore from the Dolcoth and Golden Curry properties, all shipped to Anaconda for smelting.

McClellan Creek district.—Placer gold valued at $122 was marketed during 1931 from various small placer operations in McClellan Gulch.

Whitehall district.—One placer and eight lode mines in the Whitehall district produced 70 tons of ore and old mill clean-up material, $1,489 in gold, 383 ounces of silver, 262 pounds of copper, and 24,956 pounds of lead, valued in all at $2,548. The output consisted of siliceous gold ore from the Hackensack, Sunnyside No. 1, Irene, Lone Eagle, and Ohio properties, a little clean-up material from the old Iron Rod mill, and oxidized lead ore from the Sunny Corner and Surprise mines. The placer output, valued at $72, came from various small operations on the Jefferson River near Cardwell.

Woodland Park district.—Siliceous gold ore from the Center Reef (Ballard) and Deer Horn (Callaghan) properties was shipped to smelters.

JUDITH BASIN COUNTY

The value of the production of metals in Judith Basin County was $2,166 in 1931. The marked decrease from $1,043,620 in 1930 was due to inactivity at the Block P property of the St. Joseph Lead Co. at Hughesville, a large producer of lead-zinc ore in 1930.

Barker district (*Hughesville*).—The mine output from the Barker district in 1931 was two cars of lead ore shipped from the Moulten property to the smelter at East Helena. The Block P property of the St. Joseph Lead Co. at Hughesville has been idle since September 1930.

Running Wolf Creek (*Stanford*) *district.*—A test lot of oxidized lead ore from the Running Wolf property near Windham was shipped to East Helena.

LEWIS AND CLARK COUNTY

The value of the production of metals in Lewis and Clark County in 1931 was $724,241, a decrease from $1,040,845 in 1930. There were decreases in output of all five metals, chiefly in zinc (due to lessened output from the slag fuming plant at East Helena) and in gold (due to the closing in August of the Spring Hill mine of the Montana Mines Corporation). The county ranked second to Silver Bow County in 1931 in total value of metal output, a position held by Judith Basin County in 1930.

Bald Butte district.—The Bald Butte mine was operated from May to October by the Idamont Gold Mining Co.; about 1,000 tons of gold ore were treated by amalgamation and flotation concentration. In addition to the ore milled the company shipped 2 cars of rich gold ore to Anaconda for smelting. The bullion, concentrates, and crude ore yielded gold valued at about $9,100.

Bear Gulch district.—A test lot of gold ore from the Aurora property near Rimini was shipped to Anaconda.

Canyon Creek district.—Various small placer operations on Canyon Creek yielded gold valued at $93.

Dry Gulch district.—Three placers and two lode mines in the Dry Gulch district produced 219 tons of ore, $1,198 in gold, 16 ounces of silver, and 42 pounds of lead, valued in all at $1,203. The output from lode mines, valued at $245, was chiefly low-grade gold ore from the Eula (Homestake) property treated by amalgamation. The placer output ($958) came chiefly from the Oro and York properties.

Gould district.—The Jay Gould mine was operated by lessees who treated gold ore in a small concentration plant. The resulting concentrates and 1 car of first-class gold ore were shipped for smelting. A little mill clean-up material was also marketed from the property. Most of the work was done under lease by the Standard Silver-Lead Mining Co., but the lease was relinquished late in the year.

Greenhorn district.—Placer gold valued at $112 was marketed from the Potter placer in Greenhorn Gulch near Austin.

Helena (*Unionville, Spring Hill*) *district.*—The Spring Hill mine of the Montana Mines Corporation 5 miles south of Helena was operated at a normal rate for the first 8 months of 1931. Before the shut-down August 31 the mine produced 54,526 tons of gold ore, compared with 70,751 tons in 1930. Its output of gold decreased more than 43 percent from 1930, and the property dropped to second place as a producer of gold in Montana in 1931 after the Anaconda Copper Mining Co. The company reported development in 1931 consisting of 1,132 feet of drifting, 130 feet of crosscutting, 105 feet of raising, 90 feet of sinking, and 998 feet of diamond drilling. The remainder of the district output consisted of small lots of gold ore from the Dutro property and two prospects and placer gold valued at $249, chiefly from the Crescent property in Grizzly Gulch.

Lincoln district.—Placer bullion valued at $1,409 was recovered in the Lincoln district from three placers, chiefly the Bloom & Old Billy Williams property in McClellan Gulch and the Harvey property in Sauerkraut Gulch.

Magpie Gulch district.—Placer gold valued at $120 was marketed from a property in Magpie Gulch.

Missouri River (*Trout Creek*) *district.*—Placer bullion valued at $1,111 was recovered by hydraulicking about 3,000 cubic yards of gravel at the Eldorado Bar on the Missouri River at Trout Creek northeast of Helena.

Ottawa district (*Marysville*).—Four lode mines and three tailings dumps in the Ottawa district produced 1,142 tons of ore, mill clean-up material, and old tailings yielding $9,488 in gold, 2,617 ounces of silver, 444 pounds of copper, and 181 pounds of lead, valued in all at $10,295, compared with a district output valued at $26,594 in 1930. The output in 1931 consisted of 174 tons of ore, 2 tons of old tailings, and 25 tons of mill clean-up material smelted, 11 tons of ore and 30 tons of mill clean-up material amalgamated, 100 tons of ore treated by amalgamation and concentration, and 800 tons of old tailings cyanided. Lessees operating the Bald Mountain property of the Thomas Cruse Mining & Development Co. at Marysville shipped 3 cars of gold ore to Anaconda for smelting. Lessees operating the Drumlummon mine treated 100 tons of ore by amalgamation and concentration and shipped 1 car of gold ore for smelting; 800 tons of Drumlummon tailings were re-treated by cyanidation. The Piegan-Gloster mine was operated by lessees who shipped gold ore for smelting and also material from clean-up operations at the old Gloster mill. The remainder of the district output consisted of gold ore from prospects treated by amalgamation, old tailings from the Penobscot property shipped to a smelter, and old mill clean-up material from the M & L property treated by amalgamation.

Poorman Creek district.—Placer gold valued at $124 was recovered from various small operations on Poorman Creek.

Scratch Gravel district.—A test lot of gold ore from the Ella property and small lots of lead ore from the Aster and Sunrise groups were shipped to East Helena for smelting.

Smelter district.—The East Helena lead-smelting plant of the American Smelting & Refining Co. was operated at a reduced rate for 9 months in 1931; it was closed for 3 months during the summer. The receipts were largely lead ore and concentrates from the Coeur d'Alene region, Shoshone County, Idaho, and residues from the zinc plant of the Anaconda Copper Mining Co. at Great Falls, Mont. The output of the smelter has not been made public since 1929, when bullion containing 167,562,000 pounds of lead was shipped. The output of lead was about 60 percent less in 1931 than in 1929.

The fuming plant of the Anaconda Copper Mining Co. at East Helena was operated on current slag from the lead smelter when the latter was in operation. The product, an impure zinc oxide containing a little lead and silver, was shipped to zinc plants at Great Falls, Mont., and Bartlesville, Okla., for treatment. The output of zinc decreased more than 7 percent from 1930 to 1931.

Stemple district.—Five lode mines in the Stemple district produced 131 tons of ore yielding $1,438 in gold, 557 ounces of silver, and 30 pounds of copper, valued in all at $1,603. Most of the output was gold ore from the American Boy mine treated by amalgamation. Small lots of gold ore from the Klondike, Lookout, and Independence properties were also amalgamated. First-class gold ore was shipped for smelting from the Independence and Buck Deer properties.

Vaughn district (*Rimini*).—Operations were continued at the Tatham group by the Montana Lead (Inc.) during 1931. About 800 feet of development were done, and several cars of sulphide lead ore were shipped to the smelter at East Helena. A litte gold ore from a prospect was treated by amalgamation.

Virginia Creek district.—Placer gold valued at $207 was recovered by sluicing about 100 cubic yards of gravel at the Recovery placer on Virginia Creek near Wilborn.

LINCOLN COUNTY

The value of the production of metals in Lincoln County decreased from $11,074 in 1930 to $1,965 in 1931, due chiefly to inactivity at the Hazel T. mine of the Glacier Silver-Lead Mining Co. near Libby, the chief producer in the county in 1930.

Libby district.—Two placers and two lode mines in the Libby district produced 102 tons of ore, $1,653 in gold, and 9 ounces of silver, valued together at $1,655. The output from lode mines, valued at $466, consisted of a test lot of gold ore from the Rose mine of the Midas Gold Mining & Milling Co. treated by amalgamation and 100 tons of gold ore from the Tip Top mine of the Tip Top Mines Co. treated by amalgamation and concentration. No ore was produced at the Hazel T. property of the Glacier Silver-Lead Mining Co. in 1931; the property was the chief producer in the district in 1930. The placer output, valued at $1,189, came from sluicing 800 cubic yards of gravel at the Big Cherry Creek placer and 2,000 cubic yards of gravel at the Nugget placer on Libby Creek.

Troy or Callahan Creek district.—One car of lead ore from the Iron Mask mine was shipped to East Helena for smelting.

MADISON COUNTY

The value of the production of metals in Madison County decreased from $316,745 in 1930 to $186,218 in 1931, due chiefly to lessened output from the Mammoth mine of the Liberty Montana Mines Co. at Jefferson Island.

Alder Gulch district (*Virginia City*).—Nine placers, nine lode mines, and one slag dump in the Alder Gulch district produced 1,167 tons of ore and 2 tons of slag, $13,991 in gold, 3,169 ounces of silver, and 3,404 pounds of copper, valued in all at $15,219, an increase from a district output of $9,150 in 1930. The output from lode mines in 1931, valued at $12,885, consisted of 1,143 tons of first-class gold ore of smelting grade from the Alhambra, Prospect, Prosperity, Alameda & Virginia Hope, Oro Cache, West Mapleton, Bran & Shorts, and North Star properties and siliceous gold ore treated by amalgamation at the Alameda & Virginia Hope and California properties. Bullion valued at about $2,400 was recovered by amalgamating old slag from former placer operations. The placer output came from the Eggert, Bummer Dan, Hays, Chambers, Hungerford, and Zichosch placers and various small prospects, all in Alder Gulch.

Lower Hot Springs district (*Norris*).—Nine lode mines in the Lower Hot Springs district produced 353 tons of ore yielding $9,988 in gold, 305 ounces of silver, 1,672 pounds of copper, and 110 pounds of lead, valued in all at $10,232. The output comprised 100 tons of gold ore from the Galena mine treated by flotation by the Empire Gold Mines

Co. and 253 tons of gold ore of smelting grade from the Birdia, Boaz, Josephine, Lipton, Valdez, Red Bluff, Water Lode, and Mohegan properties.

McCarthy Mountain district.—Three lode mines in the McCarthy Mountain district produced 266 tons of ore yielding $5,968 in gold, 3,306 ounces of silver, 779 pounds of copper, and 18,404 pounds of lead, valued in all at $7,679. The output was chiefly gold ore from the Hidden Treasure mine, of which about one half (108 tons) was treated by amalgamation and the remainder (98 tons) was shipped to Anaconda for smelting. A litte lead ore from the B. B. & I. E. mine was treated in a small gravity concentration plant, and first-class lead ore from the Mountain View & Vermont property was shipped to East Helena for smelting.

Mineral Hill district.—Six lode mines in the Mineral Hill district produced 12,045 tons of ore yielding $70,985 in gold, 10,832 ounces of silver, 83,719 pounds of copper, and 307 pounds of lead, valued in all at $81,755. The marked decrease in district total from $236,089 in 1930 was due chiefly to reduced output from the Mammoth mine of the Liberty Montana Mines Co. at Jefferson Island, which was idle from July to the middle of November. The output of ore from this property decreased from about 30,000 tons in 1930 to 9,270 tons in 1931, and there was a corresponding drop in the output of gold, silver, and copper; the outstanding feature of the year was the decrease of about 6,700 ounces in gold output, which caused the mine to drop to fourth place in production of gold in Montana. The Boss Tweed mine was operated by the Mineral Hill Leasing Co., and more than 2,700 tons of gold ore were treated by amalgamation and gravity concentration. The remainder of the district output was first-class gold ore shipped to smelters from the Old Joe, Oregon, and White Pine mines and from a prospect near Pony.

Norwegian district.—One placer and six lode mines in the Norwegian district produced 38 tons of ore, $6,274 in gold, 90 ounces of silver, and 185 pounds of copper, valued in all at $6,318. The output from lode mines, valued at $818, was all first-class gold ore shipped to smelters from the Big Canadian, Montana, Golden Treasure, Amy Louise, Oriole, and Mascot & Pony properties. The placer output came from the Norwegian property of the Itsik Mining Co. on Norwegian Creek near Norris, where gravels were treated in a drag-line gold separator plant.

Rabbit district.—Two placers and nine lode mines in the Rabbit district produced 294 tons of ore, $3,700 in gold, 4,616 ounces of silver, 544 pounds of copper, and 135,432 pounds of lead, valued in all at $10,100, compared with a district output of $28,866 in 1930. The output from lode mines in 1931, valued at $10,007, comprised 109 tons of first-class gold ore shipped to smelters from the California, Gold Dust, Goldstock, Picard, and Calusa properties; 38 tons of siliceous gold ore treated by amalgamation at the Goldstock and Shoemaker mines; and 147 tons of oxidized lead ore shipped from the Calvin, Jack Rabbit, and Gold Nugget mines for smelting. The placer output came chiefly from the National property near Melrose.

Ramshorn district.—Five placers and two lode mines in the Ramshorn district produced 236 tons of ore, $4,335 in gold, and 75 ounces of silver, valued together at $4,356. The placer output was valued at $2,014, compared with $1,273 in 1930; the output in 1931 came from the Camp Bird, Placer, Lindley, and other placers in Bevins Gulch. Siliceous gold ore from the Goldsmith mine was treated by amalgamation and gravity concentration, and similar material from the Standard property was amalgamated.

Sand Creek district.—Siliceous gold ore from the Chile and Whippoor-will properties was shipped to Anaconda for smelting.

Sheridan district.—Two placers and six lode mines in the Sheridan district produced 2,949 tons of ore, etc., $18,325 in gold, 1,288 ounces of silver, and 1,426 pounds of copper, valued in all at $18,829, compared with a district output of $19,188 in 1930. The output from lode mines in 1931, valued at $18,134, consisted of 373 tons of first-class smelting ore, 2,500 tons of ore and 1 ton of mill clean-up material amalgamated, and 75 tons of milling ore reduced to 5 tons of concentrates. The first-class smelting ore was all siliceous gold ore from the Cousin Jack, Bell, Nettie, and Red Pine properties. The ore amalgamated was treated in the 100-ton mill at the Emma B. property of the Smuggler Mining Co. at Sheridan. The Sunnyside Mining Co. treated 75 tons of gold ore in a 20-ton table mill and shipped 5 tons of gold concentrates to Anaconda for smelting. The placer output, valued at $695, came from operations on Wisconsin Creek near Sheridan.

Silver Star district.—One car of gold ore from the Broadway property was shipped to Anaconda for smelting, and a little gold ore from the Strawn group was treated by amalgamation.

Summit district.—About 650 tons of gold ore from the Mountain Flower mine were treated in a 30-ton amalgamation and gravity concentration plant; bullion and concentrates valued at about $1,400 were marketed. A little gold ore from the Winnetka property was treated in a small amalgamation and concentration plant by the Winnetka Mining Co.; bullion and a small lot of rich gold concentrates were marketed.

Tidal Wave district (Twin Bridges).—One placer and 12 lode mines in the Tidal Wave district produced 289 tons of ore, $11,227 in gold, 800 ounces of silver, 728 pounds of copper, and 26,092 pounds of lead, valued in all at $12,491. The output from lode mines, valued at $12,430, consisted of 171 tons of gold ore shipped to smelters from the Agatha, Corncracker, Agitator, Granger & Badger, Isabelle Extension, Urbain, Pete & Joe, and Mary Ann properties; 38 tons of first-class lead ore of smelting grade from the Ella, Iva, and Tipperary properties; and 80 tons of gold ore from the Elenora & Little Goldie mine treated in a small flotation plant. The placer output came from a property 6 miles east of Twin Bridges.

Upper Hot Springs district.—Six lode mines in the Upper Hot Springs district produced 344 tons of ore yielding $7,526 in gold, 621 ounces of silver, and 1,587 pounds of copper, valued in all at $7,850. The entire output was siliceous gold ore shipped to the smelter at Anaconda from the Bull Moose, Blue Grouse, Last Effort, Fortuna, Sundberg (Santaretta), and Revenue properties.

Washington district (Meadow Creek).—Four lode mines in the Washington district produced 100 tons of ore yielding $6,914 in gold, 458 ounces of silver, 353 pounds of copper, and 2,786 pounds of lead, valued in all at $7,182. The output consisted of 35 tons of ore from the Lehigh mine treated by amalgamation and 65 tons of first-class gold ore shipped to smelters from the Lehigh, Highland Lady No. 2, Twin Lakes, and Raphanic properties.

MEAGHER COUNTY

Beaver Creek district.—Placer bullion valued at $484 was recovered by sluicing at the Eldorado and Beaver properties on Beaver Creek north of Watson.

Musselshell district.—Small lots of siliceous gold ore from the Bullion and Surprise properties were shipped to Anaconda for smelting.

Thompson Gulch district.—Placer gold valued at $227 was marketed from two properties in Thompson Gulch.

MINERAL COUNTY

The value of the production of metals in Mineral County decreased from $12,615 in 1930 to $6,288 in 1931, chiefly because of the closing of the Iron Mountain mine north of Superior.

Cedar Creek district (*Iron Mountain, Quartz*).—Twelve placers in the Cedar Creek district produced $5,459 in gold and 8 ounces of silver, valued together at $5,462, compared with $1,342 from seven placers in 1930. In 1931 the gold ranged in fineness from 0.925 to 0.980. The output came chiefly from the Dakota and Stockholm placers on Quartz Creek, operated by sluicing, and from the Eddy & Lakawana placer on Deep Creek, operated by hydraulicking; other producers included the C. B. & Q., Stemwinder, Sterling, Windfall, Henrietta & Success, Horseshoe, and Lucky Strike placers.

St. Regis district.—A little gold ore from the Lenora property was treated in a small gravity concentration plant; the resulting concentrates, together with a little first-class gold ore, were shipped to the smelter at East Helena.

Trout Creek district.—Placer gold valued at $76 was marketed from operations on Trout Creek.

MISSOULA COUNTY

Nine Mile district.—The output from seven placers in the Nine Mile district was valued at $1,067. The Easy Strike property on McCormick Creek was again the chief producer in the district. Other active placers were the Easy Find, Deron & Barrette (Martina), Boyd, Marco, and Petty Creek properties.

PARK COUNTY

The value of the metal production in Park County increased from $729 in 1930 to $3,474 in 1931.

Emigrant Creek district.—Three placers in the Emigrant Creek district produced bullion valued at $966. Most of the output came from the Upper Falls & Hy-grade placer of the Yellowstone Gold Mining Co.; the remainder came from the property of the Emigrant Gold Mining Co. and from various small operations in Emigrant Gulch.

Sheepeater district.—The Jardine Mining Co. treated 70 tons of gold ore from the Jardine mine in a 40-ton amalgamation mill and marketed bullion valued at $2,426. The output was small compared with past years, when the mine produced considerable gold, arsenic, and tungsten.

PHILLIPS COUNTY

The production of metals in Phillips County was valued at $55,325, an increase from $14,263 in 1930, due to increased output from the August mine at Landusky.

Little Rockies district.—Most of the output from the Little Rockies district was gold ore from the August mine at Landusky shipped to East Helena for smelting. A little gold was marketed from the Big Gold placer in Grouse Gulch near Zortman.

POWELL COUNTY

The production of metals in Powell County was valued at $12,775. The increase of $6,177 from 1930 was due chiefly to larger output from placer mines in the Pioneer and Washington Gulch districts.

Big Blackfoot district.—Siliceous gold ore from the property of the Blackfoot Gold Mining Co. was treated in a 30-ton amalgamation and concentration plant built during 1930. Bullion was deposited at the assay office at Helena, and concentrates were shipped to Anaconda for smelting. A test lot of gold ore from a prospect near Helmsville was shipped to a smelter.

Nigger Hill district (*Elliston*).—A sample lot of lead ore containing considerable gold from the Big Dick property was sent to East Helena for smelting. A little gold ore from the Geraldine & Emilda group was treated by amalgamation.

Ophir district.—Sample lots of copper ore from the Nora Darling mine and gold ore from the Home property were shipped to the smelter at Anaconda. A little gold ore from the Last Chance group was amalgamated, and a little placer gold was marketed from the Jim Hill claim in Snowshoe Gulch.

Pioneer district (*Gold Creek*).—Six placers and two lode mines in the Pioneer district produced 19 tons of ore, $3,724 in gold, 46 ounces of silver, and 62 pounds of copper, valued in all at $3,743. The output from lode mines, valued at $654, was chiefly gold ore of smelting grade from the Pioneer and Independence properties; small lots of ore from both properties were amalgamated. The placer output came from the Christian, Ballard, Pineau (Friday), Anderson, and Gold Creek placers and a prospect, all on Gold Creek. The Pineau placer was the chief producer; about 3,000 cubic yards of gravel were treated by hydraulicking and yielded bullion valued at about $1,800.

Snowshoe district.—Placer gold valued at $326 was recovered at various small operations in Snowshoe Gulch.

Washington Gulch district.—The Washington Gulch Placer Mining Co. operated its sluicing equipment at the Fontana property near Finn from May until September and shipped bullion valued at about $4,200 to the assay office at Helena. One car of gold ore from the property of the Shamrock Mines (Ltd.) near Avon was shipped to a smelter.

Zozell district.—Siliceous gold and silver ore was shipped from the Blue Eyed Maggie property to the smelter at Anaconda.

RAVALLI COUNTY

Small lots of gold were marketed from a placer in the Curlew district near Victor and from the Jim placer on Hughes Creek in the Overwich district.

SANDERS COUNTY

The production of metals in Sanders County was valued at $298,318. The large increase of $157,984 over 1930 was due almost entirely to increased output of ore from the Silver King property of the Jack Waite Mining Co.

Eagle district.—In 1931, as in 1930, the Jack Waite Mining Co. operated its group of claims in the Eagle district, Shoshone County, Idaho, which extends over the State line into Sanders County, Mont. The output from the Silver King section of the property (in Montana) consisted of about 2,000 tons of rich lead ore of smelting grade and more than 48,000 tons of lead-zinc ore of milling grade. The milling ore was treated in the new 500-ton flotation plant at Duthie, Idaho, together with similar ore from the Idaho section of the property. The resulting lead concentrates and the crude lead ore were shipped to the smelter at Kellogg, Idaho, and the zinc concentrates went to the zinc plant of the Sullivan Mining Co., at Silver King, Idaho. The output was much greater than in 1930 and accounted for the increase in output from Sanders County. The property ranked first in output of lead in Montana in 1931, second in zinc, and third in silver.

Revais Creek district.—Two cars of oxidized copper ore (containing considerable gold) from the Dixon property were shipped to the smelter at Anaconda.

Thompson River district.—One car of sulphide copper ore from the Copper Mask property near Thompson Falls was shipped to Anaconda for smelting.

SILVER BOW COUNTY

Eight mines in Silver Bow County were productive in 1931 compared with 16 mines and 2 dumps in 1930. Most of the output in 1931 resulted from the operations of two companies at Butte. Several large producers of copper ore and all producers of lead ore, lead-zinc ore, and zinc ore were closed during 1930 and remained inactive during 1931. The output of gold decreased $61,254, that of silver 1,558,803 ounces, and that of copper 11,110,072 pounds. No lead or zinc was produced from Silver Bow County in 1931; 5,080,221 pounds of lead and 27,967,972 pounds of zinc were produced in 1930. The total value of the metal output decreased $11,243,670. All but 60 tons of the material produced was classified as copper ore or old tailings, and more than 95 percent of the copper material was treated in the copper concentration mill at Anaconda. The ore milled yielded copper concentrates containing metals valued at $16,497,567, or $46.23 a ton of concentrates. The crude smelting ore yielded on the average $10.40 in metals a ton. Old copper tailings amounting to 18,613 tons were smelted.

Production of gold, silver, copper, lead, and zinc in Silver Bow County, Mont., 1930 and 1931, in terms of recovered metals

Year	Mines producing	Ore, old tailings, etc.	Gold (lode and placer)	Silver (lode and placer)	Copper [1]	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1930	18	2,351,836	$268,188	5,257,545	195,471,941	5,080,221	27,967,972	$29,300,169
1931	8	1,869,348	206,934	3,698,742	184,361,869	------------	------------	18,056,499

[1] Includes copper recovered from precipitates, as follows: 1930, 11,465,232 pounds; 1931, 9,092,564 pounds.

Butte or Summit Valley district.—Three lode mines in the Summit Valley district produced 1,869,330 tons of ore and old tailings, $206,268 in gold, 3,698,676 ounces of silver, and 184,361,564 pounds of copper (including 9,092,564 pounds from precipitates), valued in all at $18,055,786, a decrease from $29,300,026 in 1930. An unusually large decrease was recorded in the production of each of the five metals; no lead or zinc was produced in 1931. Excluding the value of the copper recovered from precipitates, the ore and old tailings yielded on the average $9.22 in metals a ton. The output consisted of 67,260 tons of first-class smelting ore, 18,613 tons of old tailings smelted, and 1,783,457 tons of concentrating ore reduced to 356,822 tons of concentrates.

Production records before 1882 are not available. From 1882 to the end of 1931 Silver Bow County, which includes the Butte district, yielded gold, silver, copper, lead, and zinc valued at $2,166,766,832, as follows: Gold, $37,287,517; silver, $329,000,728; copper, $1,572,192,678; lead, $21,016,091; and zinc, $207,269,818. These values represent 1,803,783.58 ounces of gold, 460,523,738 ounces of silver, 10,286,971,259 pounds of copper, 314,289,223 pounds of lead, and 2,567,395,925 pounds of zinc.

According to the company's printed annual report for 1931 the mines of the Anaconda Copper Mining Co. continued to produce copper ore at a reduced rate; but the zinc mines were inactive, having been closed in 1930 as a result of low metal prices. The Anaconda smelting plant produced 173,440,855 pounds of copper, 3,640,066 ounces of silver, and 19,486.20 ounces of gold; nearly all the copper and silver came from mines at Butte, but nearly one half of the gold came from custom shipments from mines outside of Silver Bow County. The company was the largest producer of gold, silver, and copper in Montana in 1931. The electrolytic copper refinery and the rod and wire mill at Great Falls were active throughout the year at a reduced rate, but operating details were not published in the annual report. The electrolytic zinc plant at Great Falls was operated the entire year, but the Anaconda plant was closed in June. Most of the zinc material received at the plants was zinc concentrates from mills in Idaho and Utah. The production of electrolytic zinc at the two plants was 125,983,883 pounds. In addition, metals in residue and dross amounted to 4,391,680 pounds of lead, 1,216,108 pounds of copper, 451,345 ounces of silver, and 5,210.62 ounces of gold. Of this amount 948,260 pounds of copper, 25,139 ounces of silver, and 73.70 ounces of gold were treated through operations of the copper plant. According to the company's annual reports, dividends amounting to $12,224,517 were paid during 1931 (including a dividend of $5,543,860 declared in December 1930 and paid in February 1931), part of which was paid from receipts from operations in other States. Operating income for the year was $6,409,427, and after other income was added and depreciation and interest were deducted net loss to surplus was $3,151,727. After payment of dividends surplus at the end of the year was $69,613,562. Construction expenditures by the Anaconda Copper Mining Co. and its subsidiary companies during the year were $2,969,227. Total development at all company mines at Butte during 1931 was 21.31 miles of workings.

The Emma mine of the Butte Copper & Zinc Co. continued to be operated under lease by the Anaconda Copper Mining Co. No zinc ore or lead-zinc ore was mined during 1931, but the company continued to ship manganese ore. According to the company's printed annual report, manganese ore shipments amounted to 20,057 short tons, and the company received $49,874 from the lessee. Operating loss for the year was $29,782, and surplus at the end of the year was $533,018.

The work of salvaging the underground equipment from the property of the Butte & Superior Mining Co. was completed in February, and the workings were abandoned.

The North Butte Mining Co. continued operations at its Granite Mountain and Main Range properties during only the first 5 months of 1931; work was then suspended due to the low price of copper. The company shipped more than 10,000 tons of copper ore to Anaconda before the shut-down. Most of the ore was of milling grade and was treated in the copper concentrator of the Anaconda Copper Mining Co. The company's printed annual report covering operations in 1931 did not include a profit and loss statement.

Divide Creek district.—A test lot of gold ore from the Lincoln mine 20 miles south of Butte was shipped to Anaconda for smelting.

Highlands district.—A small lot of gold ore from the Highlands (Tilton) property 15 miles south of Butte was shipped to the smelter at Anaconda.

Lost Child district.—From the Lizzie mine a test lot of gold ore was amalgamated and a little first-class gold ore shipped for smelting. A little placer bullion was marketed from the Portland property.

STILLWATER COUNTY

Yellowstone River district.—Gold valued at $76 was marketed from the Florence placer on the Yellowstone River near Columbus.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN COLORADO[1]

(MINE REPORT)

By C. W. Henderson

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SUMMARY

The total calculated gross value of the recovered and estimated recoverable gold, silver, copper, lead, and zinc from gravels handled and ores mined in Colorado in 1931 decreased 40 percent from the gross value in 1930, following a decrease of 13 percent in 1930 from 1929. The value of gold increased 7 percent; the value of silver decreased 62 percent, copper 46 percent, lead 77 percent, and zinc 65 percent. There were 340 lode mines and 195 placers producing in 1931 and 313 lode mines and 21 placers in 1930, an increase of 27 lode mines and 174 placers.

The total recorded value of gold ($720,301,766), silver ($519,162,015), copper ($47,152,331), lead ($217,576,061), and zinc ($157,007,556), all in terms of recovered metals, produced from Colorado ores and gravels from 1858 to 1931, inclusive, is $1,661,199,729. The total quantities are 34,844,598 ounces of gold, 660,127,833 ounces of silver, 313,405,430 pounds of copper, 4,607,340,583 pounds of lead, and 2,230,125,985 pounds of zinc.[2]

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

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[1] Work on manuscript completed October 1932.

[2] For details 1858 to 1923, see Henderson, C. W., Mining in Colorado: U.S. Geol. Survey Prof. Paper 138, 1926, 263 pp.; for recapitulation by years 1858 to 1925, see Gold, Silver, Copper, Lead, and Zinc in Colorado: Mineral Resources of the United States, 1925, Pt. I, opp. p. 701.

Prices of silver, copper, lead, and zinc, 1926–31

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1926	$0.624	$0.140	$0.080	$0.075	1929	$0.533	$0.176	$0.063	$0.066
1927	.567	.131	.063	.064	1930	.385	.130	.050	.048
1928	.585	.144	.058	.061	1931	.290	.091	.037	.038

Mine production of gold, silver, copper, lead, and zinc in Colorado, 1926–31, in terms of recovered metals

Year	Mines producing			Ore sold or treated (short tons)	Gold			Silver (lode and placer)	
	Lode	Placer	Total		Lode	Placer	Total	Fine ounces	Value
1926	387	31	418	1,839,740	$7,031,079	$46,954	$7,078,033	4,704,122	$2,935,372
1927	330	19	349	1,606,528	5,184,684	94,434	5,279,118	3,784,605	2,145,871
1928	336	23	359	1,426,084	5,243,470	61,406	5,304,876	4,052,253	2,370,568
1929	290	13	303	1,172,193	4,371,508	45,850	4,417,358	4,397,377	2,343,802
1930	313	21	334	1,335,731	4,379,376	138,243	4,517,619	4,382,852	1,687,398
1931	340	195	535	1,036,562	4,801,148	21,586	4,822,734	2,195,914	636,815

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1926	3,403,850	$476,539	68,987,800	$5,519,024	65,000,000	$4,875,000	$20,883,968
1927	5,670,581	742,846	66,772,557	4,206,671	71,729,000	4,590,656	16,965,162
1928	8,594,646	1,237,629	53,501,723	3,103,100	71,462,000	4,359,182	16,375,355
1929	8,905,074	1,567,293	48,889,906	3,080,064	58,861,000	3,884,826	15,293,343
1930	10,514,000	1,366,820	44,260,000	2,213,000	72,518,000	3,480,864	13,265,701
1931	8,165,000	743,015	13,768,000	509,416	32,373,000	1,230,174	7,942,154

Gold and silver produced at placer mines in Colorado, 1927–31, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Dredging		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
1927	364.38	73	4,203.87	1,063	4,568.25	1,136
1928	502.45	100	2,468.06	628	2,970.51	728
1929	355.72	60	1,862.27	488	2,217.99	548
1930	358.90	57	6,328.61	1,600	6,687.51	1,657
1931	777.32	121	266.90	69	1,044.22	190

GOLD

The production of gold in Colorado in 1931, in terms of recovered metal, was 233,299.75 fine ounces, valued at $4,822,734, an increase from 1930 of 14,759.93 fine ounces ($305,115).

The Cripple Creek district contributed $2,385,769 (49 percent of the total yield). Park County yielded $871,789 (18 percent), San Juan $647,208 (13 percent), Gilpin $338,404 (7 percent), and Ouray $201,764 (4 percent) of the State total. The largest increases were $419,647 in Park County, $198,694 in Gilpin, $52,380 in Ouray, $11,092 in Boulder, $4,270 in La Plata, and $1,674 in Pitkin. The largest decreases were $146,263 in Teller County, $117,632 in Summit, $40,057 in Eagle, $26,639 in Clear Creek, $14,168 in San Juan, $12,946 in Gunnison, $11,209 in Saguache, $7,908 in Dolores, and $7,537 in Rio Grande.

The yield of placer gold was $21,586, a decrease of $116,657 from 1930. Summit County, with 1 dredge, 6 hydraulic mines, and 14 sluice mines, produced 48 percent of the placer gold. The other counties producing placer gold in 1931 were Adams, Arapahoe, Chaffee, Clear Creek, Denver, Douglas, Eagle, Elbert, Gilpin, Gunnison, Jefferson, Lake, Moffat, Montrose, Ouray, Park, Routt, San Miguel, and Teller. The Continental Dredging Co. dredge at Breckenridge was operated only 2 months and 6 days and produced only 266.90 fine ounces compared with 6,328.61 fine ounces in 1930.

SILVER

The production of silver in Colorado in 1931, in terms of recovered metal, was 2,195,914 fine ounces, valued at $636,815, a decrease of 2,186,938 ounces in quantity and $1,050,583 in value from 1930, after a decrease of 14,525 ounces in quantity and $656,404 in value from 1929. In 1931 Eagle County produced 68 percent, San Juan 20 percent, Lake 4 percent, and Ouray 2 percent of the State total. The largest increases were 22,464 ounces in Ouray County and 16,822 ounces in Park. The largest decreases were 636,703 ounces in San Juan County, 535,617 ounces in Lake, 396,044 ounces in Mineral, 332,215 ounces in Saguache, 123,443 ounces in Eagle, 81,030 ounces in Dolores, and 78,232 ounces in San Miguel.

COPPER

The production of recoverable copper in Colorado in 1931 was 8,165,000 pounds, valued at $743,015, a decrease of $623,805 from 1930, after a decrease of $200,473 from 1929. Eagle County produced more than 81 percent of the copper output, San Juan more than 15 percent, and Gilpin 1 percent. The combined output of the other counties producing copper was about 2 percent of the State total in 1931. The production in Eagle County increased from 5,849,000 pounds in 1930 to 6,647,000 pounds in 1931, but the value decreased from $760,370 to $604,877. The largest decreases were 1,427,495 pounds in quantity and $234,344 in value in San Juan County, 1,229,000 pounds in quantity and $159,965 in value in Saguache, 307,000 pounds in quantity and $39,988 in value in Dolores, and 218,692 pounds in quantity and $29,729 in value in Lake.

LEAD

The production of recoverable lead in Colorado in 1931, reckoned as lead in lead bullion and in leaded zinc oxide, was 13,768,000 pounds, valued at $509,416, a decrease of $1,703,584 from 1930. There were decreases in all the important lead-producing counties except Eagle, which had an increase of 1,989,000 pounds in quantity and $247 in value; Park and Ouray Counties had small increases in both quantity and value of output. Lead ores yielded 973,867 pounds and lead-zinc ores 9,313,000 pounds. Smelting ores of all kinds yielded 4,741,949 pounds, and concentrates of all kinds smelted yielded 9,026,051 pounds.

ZINC

The zinc-bearing ores marketed from Colorado in 1931 contained 32,373,000 pounds of recoverable zinc, valued at $1,230,174, a decrease of 40,145,000 pounds in quantity and $2,250,690 in value from 1930. Eagle County led in zinc production in 1931 with 26,518,000 pounds (nearly 82 percent of the zinc output of the State) compared with 28,544,000 pounds (39 percent) in 1930. Lake County ranked second with 5,773,000 pounds (nearly 18 percent of the total) compared with 23,038,000 pounds (32 percent) in 1930. Dolores County ranked third with only 82,000 pounds. No zinc was recovered from ores mined in other counties of the State.

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1931, by counties, in terms of recovered metals

County	Mines producing			Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Total	Fine ounces	Value	Fine ounces	Value
Adams		3	3	66.03	$1,365	7	$2
Arapahoe		1	1	11.22	232		
Boulder	71		71	1,335.54	27,608	3,545	1,028
Chaffee	1	18	19	122.49	2,532	14	4
Clear Creek	31	41	72	3,652.41	75,502	22,614	6,558
Custer	2		2	32.70	676	410	119
Denver		39	39	28.93	598		
Dolores	2		2	33.72	697	1,648	478
Douglas		23	23	39.08	808		
Eagle	3	1	4	3,728.55	77,076	1,497,131	434,168
Elbert		1	1	1.93	40		
Gilpin	28	12	40	16,370.29	338,404	20,807	6,034
Gunnison	5	10	15	183.68	3,797	4,107	1,191
Hinsdale	2		2	29.46	609	207	60
Jefferson		1	1	1.60	33		
Lake	29	5	34	5,054.71	104,490	81,183	23,543
La Plata	10		10	616.88	12,752	2,317	672
Moffat	2	4	6	8.95	185	100	29
Montrose		4	4	18.19	376	7	2
Ouray	9	3	12	9,760.34	201,764	40,586	11,770
Park	15	1	16	42,172.79	871,789	28,531	8,274
Pitkin	7		7	85.72	1,772	37,169	10,779
Rio Grande	4		4	50.94	1,053	76	22
Routt		1	1	4.55	94		
Saguache	3		3	7.93	164	1,507	437
San Juan	10		10	31,308.69	647,208	430,793	124,930
San Miguel	23	4	27	2,209.13	45,667	9,324	2,704
Summit	6	21	27	951.73	19,674	5,631	1,633
Teller	77	2	79	115,411.57	2,385,769	8,200	2,378
	340	195	535	233,299.75	4,822,734	2,195,914	636,815
Total, 1930	313	21	334	218,539.82	4,517,619	4,382,852	1,687,398

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams							$1,367
Arapahoe							232
Boulder			4,595	$170			28,806
Chaffee							2,536
Clear Creek	8,758	$797	94,000	3,478			86,335
Custer			15,487	573			1,368
Denver							598
Dolores	2,000	182	69,000	2,553	82,000	$3,116	7,026
Douglas							808
Eagle	6,647,000	604,877	7,631,000	282,347	26,518,000	1,007,684	2,406,152
Elbert							40
Gilpin	95,000	8,645	92,700	3,430			356,513
Gunnison	505	46	76,784	2,841			7,875
Hinsdale							669
Jefferson							33
Lake	33,308	3,031	2,940,514	108,799	5,773,000	219,374	459,237
La Plata			190	7			13,431
Moffat	18,000	1,638					1,852
Montrose							378
Ouray	73,331	6,673	368,052	13,618			233,825
Park	21,198	1,929	779,190	28,830			910,822
Pitkin	1,000	91	282,000	10,434			23,076
Rio Grande							1,075
Routt							94
Saguache	5,000	455	62,000	2,294			3,350
San Juan	1,250,505	113,796	1,134,000	41,958			927,892
San Miguel	5,395	491	183,488	6,789			55,651
Summit	4,000	364	35,000	1,295			22,966
Teller							2,388,147
	8,165,000	743,015	13,768,000	509,416	32,373,000	1,230,174	7,942,154
Total, 1930	10,514,000	1,366,820	44,260,000	2,213,000	72,518,000	3,480,864	13,265,701

Gold and silver produced at lode and placer mines in Colorado in 1931, by counties, in terms of recovered metals

County	Lode mines					Placer mines				Grand total value
	Ore sold or treated	Gold	Silver		Total value	Gold	Silver		Total value	
	Short tons		*Fine ounces*				*Fine ounces*			
Adams						$1,365	7	$2	$1,367	$1,367
Arapahoe						232			232	232
Boulder	2,240	$27,608	3,545	$1,028	$28,636					28,636
Chaffee	38	759			759	1,773	14	4	1,777	2,536
Clear Creek	14,551	74,799	22,607	6,556	81,355	703	7	2	705	82,060
Custer	39	676	410	119	795					795
Denver						598			598	598
Dolores	204	697	1,648	478	1,175					1,175
Douglas						808			808	808
Eagle	204,695	76,943	1,497,131	434,168	511,111	133			133	511,244
Elbert						40			40	40
Gilpin	262,829	335,210	20,783	6,027	341,237	3,194	24	7	3,201	344,438
Gunnison	357	3,204	4,100	1,189	4,393	593	7	2	595	4,988
Hinsdale	11	609	207	60	669					669
Jefferson						33			33	33
Lake	24,912	104,137	81,183	23,543	127,680	353			353	128,033
La Plata	404	12,752	2,317	672	13,424					13,424
Moffat	36	10	100	29	39	175			175	214
Montrose						376	7	2	378	378
Ouray	19,230	201,658	40,586	11,770	213,428	106			106	213,534
Park	11,497	871,681	28,531	8,274	879,955	108			108	880,063
Pitkin	4,014	1,772	37,169	10,779	12,551					12,551
Rio Grande	177	1,053	76	22	1,075					1,075
Routt						94			94	94
Saguache	97	164	1,507	437	601					601
San Juan	172,430	647,208	430,793	124,930	772,138					772,138
San Miguel	3,792	45,433	9,324	2,704	48,137	234			234	48,371
Summit	11,124	9,268	5,507	1,597	10,865	10,406	124	36	10,442	21,307
Teller	303,885	2,385,507	8,200	2,378	2,387,885	262			262	2,388,147
	1,036,562	4,801,148	2,195,724	636,760	5,437,908	21,586	190	55	21,641	5,459,549
Total, 1930	1,335,731	4,379,376	4,381,195	1,686,760	6,066,136	138,243	1,657	638	138,881	6,205,017

Gold and silver produced at placer mines in Colorado in 1931, by counties, in fine ounces

County	Sluicing and hydraulic		Dredging		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
Adams	66.03	7			66.03	7
Arapahoe	11.22				11.22	
Chaffee	85.77	14			85.77	14
Clear Creek	34.01	7			34.01	7
Denver	28.93				28.93	
Douglas	39.08				39.08	
Eagle	6.43				6.43	
Elbert	1.93				1.93	
Gilpin	154.51	24			154.51	24
Gunnison	28.69	7			28.69	7
Jefferson	1.60				1.60	
Lake	17.08				17.08	
Moffat	8.47				8.47	
Montrose	18.19	7			18.19	7
Ouray	5.13				5.13	
Park	5.22				5.22	
Routt	4.55				4.55	
San Miguel	11.32				11.32	
Summit	236.49	55	266.90	69	503.39	124
Teller	12.67				12.67	
	777.32	121	266.90	69	1,044.22	190
Total, 1930	358.90	57	6,328.61	1,600	6,687.51	1,657

MINING INDUSTRY

Operating details are given under Review by Counties and Districts, page 520, and significant statistical details are given in the tables throughout the report. The significant operating details of mining in Colorado were reviewed in the press notice, "Metal Mining in Colorado, 1931", released by the Bureau of Mines January 22, 1932.

ORE CLASSIFICATION

Ore sold or treated in Colorado in 1931, with content in terms of recovered metals

Source	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	628,007	196,691.67	125,327	209,227	1,239,819	
Dry gold and silver ore	171,592	30,986.05	428,967	1,214,205	923,614	
Dry silver ore	12,020	97.10	98,245	15,208	617,000	
	811,619	227,774.82	652,539	1,438,640	2,780,433	
Copper ore	57,232	3,098.20	1,381,995	6,547,000	617,700	
Copper-lead ore	144	45.49	4,182	9,000	83,000	
Lead ore	5,410	662.04	38,317	48,360	973,867	
Lead-zinc ore	162,157	674.98	118,691	122,000	9,313,000	32,373,000
	224,943	4,480.71	1,543,185	6,726,360	10,987,567	32,373,000
Total, lode mines	1,036,562	232,255.53	2,195,724	8,165,000	13,768,000	32,373,000
Total, placers		1,044.22	190			
	1,036,562	233,299.75	2,195,914	8,165,000	13,768,000	32,373,000
Total, 1930	1,335,731	218,539.82	4,382,852	10,514,000	44,260,000	72,518,000

METALLURGIC INDUSTRY

Details of the metallurgic industry of the State are amply shown in the tables that follow. Practically all the concentrates from Colorado indicated herein were recovered by flotation and hence need not be divided by methods of recovery.

Mine production of metals in Colorado in 1931, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	563,563	52,372.85	9,524			
Ore, concentrates, sands, and slimes cyanided	278,026	89,756.99	20,639			
Concentrates smelted	53,406	43,527.00	655,489	1,558,939	9,026,051	26,518,000
Ore smelted	91,783	46,598.69	1,510,072	6,606,061	4,741,949	5,855,000
Placer		1,044.22	190			
		233,299.75	2,195,914	8,165,000	13,768,000	32,373,000
Total, 1930		218,539.82	4,382,852	10,514,000	44,260,000	72,518,000

Ore treated by amalgamation, ore, concentrates, sands, and slimes treated by cyanidation, and gold and silver contained in bullion and precipitates in Colorado in 1931

Process	Material treated	Gold in bullion	Silver in bullion	Quicksilver purchased	Sodium cyanide used
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amalgamation	563,563	52,372.85	9,524	1,624	--------
Cyanidation	[1] 278,026	89,756.99	20,639	--------	[2] 368,845

[1] Includes 13,835 tons of raw ore and concentrates treated by direct cyanidation and 264,191 tons of sands and slimes from ore first amalgamated.

[2] Reduced to equivalent of 96 to 98 percent strength. Actually 721,596 pounds of cyanamid of approximately 48 to 49 percent strength and 8,047 pounds of sodium cyanide of 96 to 98 percent strength.

Mine production of metals from gold and silver mills in Colorado in 1931, by counties, in terms of recovered metals

County	Ore treated	Recovered in bullion		Concentrates and recovered metal					
		Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Boulder	2,238	1,288.65	2,076	16	46.49	1,453	--------	3,649	--------
Chaffee	38	36.72	--------	--------	--------	--------	--------	--------	--------
Clear Creek	13,544	2,125.97	6,245	378	1,206.20	14,473	3,205	44,400	--------
Custer	15	32.20	18	--------	--------	--------	--------	--------	--------
Eagle	8	9.72	159	--------	1.60	--------	--------	--------	--------
Gilpin	261,762	10,188.38	2,666	2,883	5,886.66	16,878	93,800	64,000	--------
Gunnison	206	60.03	14	--------	--------	--------	--------	--------	--------
Hinsdale	9	16.56	7	--------	--------	--------	--------	--------	--------
Lake	961	1,331.11	1,931	--------	--------	--------	--------	--------	--------
La Plata	362	550.76	1,959	--------	--------	--------	--------	--------	--------
Ouray	17,005	6,024.92	2,298	988	3,228.79	21,926	72,331	285,052	--------
Park	2,531	2,982.71	3,241	191	1,275.98	1,587	9,200	33,000	--------
Pitkin	--------	7.33	1	--------	--------	--------	--------	--------	--------
Rio Grande	177	19.19	1	5	31.75	75	--------	--------	--------
Saguache	1	4.14	--------	--------	--------	--------	--------	--------	--------
San Juan	--------	368.39	182	--------	--------	--------	--------	--------	--------
San Miguel	2,112	1,292.01	959	44	130.40	286	--------	2,800	--------
Summit	11,003	392.15	206	--------	--------	--------	--------	--------	--------
Teller	303,885	115,398.90	8,200	--------	--------	--------	--------	--------	--------
	615,857	142,129.84	30,163	4,505	11,807.87	56,678	178,536	432,901	--------
Total, 1930	470,634	146,795.64	204,268	2,501	7,149.74	69,126	96,900	429,540	95,000

Mine production of metals from concentrating mills in Colorado in 1931, by counties, in terms of recovered metals

County	Ore treated	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clear Creek	890	117	165.40	776	3,703	25,250	------------
Eagle	147,505	39,609	647.00	117,813	120,000	7,014,000	26,518,000
Gilpin	1,000	118	77.40	477	1,200	400	------------
Ouray	2,000	93	13.10	8,879	500	67,000	------------
Pitkin	3,500	195	------------	33,666	------------	190,000	------------
San Juan	172,404	8,543	30,767.70	429,721	1,250,000	1,119,000	------------
San Miguel	1,602	223	48.03	7,395	5,000	176,500	------------
Summit	21	3	.50	84	------------	1,000	------------
	328,922	48,901	31,719.13	598,811	1,380,403	8,593,150	26,518,000
Total, 1930	739,003	136,233	33,707.22	1,948,121	4,291,753	37,325,267	68,138,000

Gross metal content of concentrates produced from ores mined in Colorado in 1931, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper (wet assay)	Lead (wet assay)	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	1,722	2,881.31	5,517	1,621	3,645	31,200
Copper	1,348	3,412.29	13,289	120,583	63,043	348,216
Copper-lead	9,531	33,996.49	451,647	1,653,234	1,560,751	1,366,435
Lead	8,200	3,367.40	185,820	173,259	7,838,823	1,252,612
Zinc	32,605	374.00	80,814	223,295	847,420	32,339,280
	53,406	44,031.49	737,087	2,171,992	10,313,682	35,337,743
Total, 1930	138,734	41,609.94	2,115,624	5,803,933	46,283,422	91,132,379

Mine production of metals from Colorado concentrates in 1931, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Boulder	16	46.49	1,453		3,649	
Clear Creek	495	1,371.60	15,249	6,908	69,650	
Eagle	39,609	648.60	117,813	120,000	7,014,000	26,518,000
Gilpin	3,001	5,964.06	17,355	95,000	64,400	
Ouray	1,081	3,241.89	30,805	72,831	352,052	
Park	191	1,275.98	1,587	9,200	33,000	
Pitkin	195		33,666		190,000	
Rio Grande	5	31.75	75			
San Juan	8,543	30,767.70	429,721	1,250,000	1,119,000	
San Miguel	267	178.43	7,681	5,000	179,300	
Summit	3	.50	84		1,000	
	53,406	43,527.00	655,489	1,558,939	9,026,051	26,518,000
Total, 1930	138,734	40,856.96	2,017,247	4,388,653	37,754,807	68,233,000

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry gold	1,722	2,751.80	4,733	1,200	3,200	
Copper	1,348	3,412.29	13,289	97,097	56,250	
Copper-lead	9,531	33,996.49	451,647	1,322,331	1,404,052	
Lead	8,200	3,366.42	185,820	138,311	7,054,549	
Total to copper and lead plants	20,801	43,527.00	655,489	1,558,939	8,518,051	
Zinc	32,605				[1] 508,000	[2] 26,518,000
	53,406	43,527.00	655,489	1,558,939	9,026,051	26,518,000

[1] Lead recovered in leaded zinc oxide.

[2] Zinc recovered as metal and zinc in zinc oxide.

Gross metal content of Colorado crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Ore		Gross metal content				
			Gold	Silver	Copper	Lead	Zinc
	Short tons	*Percent*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	10, 793	11. 76	42, 738. 61	42, 575	33, 603	884, 573	682, 944
Dry gold and silver	226	. 24	260. 40	2, 474	4, 773	2, 009	
Dry silver	6, 499	7. 08	83. 50	55, 616	18, 607	398, 651	
Copper	57, 232	62. 36	3, 098. 20	1, 381, 995	6, 819, 758	1, 235, 813	1, 143, 706
Copper-lead	144	. 16	45. 50	4, 182	10, 209	91, 275	
Lead	2, 237	2. 44	344. 53	22, 356	3, 026	651, 779	11, 554
Lead-zinc	14, 652	15. 96	324. 78	29, 924	3, 847	3, 273, 957	7, 322, 450
	91, 783	100. 00	46, 895. 52	1, 539, 122	6, 893, 823	6, 538, 057	9, 160, 654
Total, 1930	126, 094		24. 563. 49	2, 208, 184	6, 419, 997	8, 144, 715	9, 878, 110

Mine production of metals from Colorado crude ore shipped to smelters in 1931, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Boulder	2	0. 40	16		946	
Clear Creek	117	120. 83	1, 113	1, 850	24, 350	
Custer	24	. 50	392		15, 487	
Dolores	204	33. 72	1, 648	2, 000	69, 000	82, 000
Eagle	57, 182	3, 063. 80	1, 379, 159	6, 527, 000	617, 000	
Gilpin	67	63. 34	762		28, 300	
Gunnison	151	94. 96	4, 086	505	76, 784	
Hinsdale	2	12. 90	200			
Lake	23, 951	3, 706. 52	79, 252	33, 308	2, 940, 514	5, 773, 000
La Plata	42	66. 12	358		190	
Moffat	36	. 48	100	18, 000		
Ouray	225	488. 40	7, 483	500	16, 000	
Park	8, 966	37, 908. 88	23, 703	11, 998	746, 190	
Pitkin	514	78. 39	3, 502	1, 000	92, 000	
Saguache	96	3. 79	1, 507	5, 000	62, 000	
San Juan	26	172. 60	890	505	15, 000	
San Miguel	78	727. 37	684	395	4, 188	
Summit	100	55. 69	5, 217	4, 000	34, 000	
	91, 783	46, 598. 69	1, 510, 072	6, 606, 061	4, 741, 949	5, 855, 000
Total, 1930	126, 094	24, 199. 71	2, 159, 680	6, 125, 347	6, 505, 193	4, 285, 000

BY CLASSES OF ORE

Dry gold	10, 793	42, 738. 61	42, 575	26, 993	795, 768	
Dry gold and silver	226	260. 40	2, 474	4, 000	1, 614	
Dry silver	6, 499	83. 50	55, 616	14, 708	359, 000	
Copper	57, 232	3, 098. 20	1, 381, 995	6, 547, 000	617, 700	
Copper-lead	144	45. 49	4, 182	9, 000	83, 000	
Lead	2, 237	344. 51	22, 352	2, 360	585, 867	
Total to copper and lead plants	77, 131	46, 570. 71	1, 509, 194	6, 604, 061	2, 442, 949	
Lead-zinc	14, 652	27. 98	878	2, 000	2, 299, 000	5, 855, 000
	91, 783	46, 598. 69	1, 510, 072	6, 606, 061	4, 741, 949	5, 855, 000

REVIEW BY COUNTIES AND DISTRICTS

ADAMS COUNTY

Sluice boxes placed below the waste flumes of the Brannan, Carlson, and Gordon gravel plants on Clear Creek recovered $1,365 in gold and 7 ounces of silver in 1931. The bulk of the production came from the Gordon plant between June 1 and September 1. The excavator for this gravel plant consists of one drag-line excavator with a capacity of 300 cubic yards per 24 hours. The report of the lessee indicates that the yardage handled yielded $0.061 per yard. The average yearly fineness of the Gordon yield, after being melted at the Denver Mint, was 0.809½ in gold and 0.118 in silver. Two lots from the Brannan plant averaged 0.719 fine in gold and 0.113 fine in silver, and one lot averaged 0.596 in gold and 0.086 in silver. The fineness of the Carlson yield was 0.831 in gold and 0.115 in silver. From 1922, when the sluices were first placed below these and other gravel and sand plants, to 1931, inclusive, $22,835 in gold and 161 ounces of silver have been recovered. Production of the county before 1922 is covered in the 1928 report of this series.

ALAMOSA COUNTY

Development, as required assessment work, was done in 1931 at the Red Eagle prospect in the West Blanca district.

ARAPAHOE COUNTY

A lessee on the Enos Ranch near Englewood sluiced from the gravel of Little Dry Creek 14.89 crude ounces of placer gold, which when melted at the Denver Mint weighed 11.46 ounces averaging 0.976 fine in gold and 0.018 fine in silver.

ARCHULETA COUNTY

Development work was continued at the Treasure Comstock prospect in Archuleta County west of Summitville, Rio Grande County. Accurate surveys are lacking but the property is presumably in sec. 1, T. 36 N., R. 3 E., New Mexico principal meridian. The mineralization is lead-zinc-silver-gold-copper sulphide, replacing limestone beds.

BACA COUNTY

Assessment work was continued at the Independence prospect near Utleyville. Production from this region in the past has been from rounded nodules of chalcocite in a white sandstone. Exhaustive field work by oil geologists in the region seems to indicate that the part of the white sandstone containing the chalcocite nodules is not continuous but exists as irregular remnants, with the next higher geological sedimentary bed lying unconformably upon the eroded white limestone bed.

BOULDER COUNTY

The bulk of the ore mined in Boulder County was sampled and bought by the Boulder Ore Sampling Works, at Boulder, which reshipped nearly all the ore to the Golden Cycle mill. Other shipments went direct to the Golden Cycle mill.

Central district (*Jamestown*).—In 1931 small lots, ranging from specimen gold to 175 tons of ore, from 13 properties aggregated 241 tons and yielded $3,161 in gold, 69 ounces of silver, and 946 pounds of lead. Production was from the following properties: Blue Jay, Buckhorn, Cashier, Cracker Jack, Emily, Eureka, Havana, Kaiser, Kicking Horse, Nelson, Pacific, Stanley, and Wano.

Gold Hill district.—In the Gold Hill district 19 individual properties in 1931 yielded small lots ranging from specimen gold to 280 tons of ore. The material was treated variously by hand mortars, by crushing and amalgamation, by table concentration, and by the custom cyanidation mill at Colorado Springs and yielded $7,551 in gold and 1,131 ounces of silver. The properties were the Big Horn, California, Cash, Charles, Emancipation, Golden Eagle, Horsfal, Lucky Star, Morning Glory, Princeton, Right Change, St. Joe, Salina, Slide-Corning group, Tiger, Two Brothers, United Mines Co. group, Valley Forge, and Washburn.

Grand Island district (*Cardinal, Caribou, Eldora, and Nederland*).—In 1931 reopening of old properties in the vicinity of Nederland resulted in shipments of gold ore, as follows: 2 tons from the Bonanza-Mascotte group at Eldora, 0.28 ton from the Revenge at Caribou, 0.37 ton from the Shirley group near Lost Lake, and 2 tons from the St. Louis at Caribou. At the Potosi group at Caribou, under development and operation for several years, 250 feet of development drifts were run; the crushing and grinding equipment of the mill was changed from stamps to one Gates crusher and two 150-ton ball mills. The mine was operated 365 days; the mill was operated 118 days and yielded gold amalgam and 16 tons of lead concentrates, the latter containing 46.49 ounces of gold and 1,453 ounces of silver. The concentrates were a composite recovered by flotation and gravity concentration.

Magnolia district.—Small lots of ore aggregating 177 tons and containing 157.21 ounces of gold and 47 ounces of silver were shipped from 10 properties in the Magnolia district in 1931. Producing properties were the American, Anna Clara, Cash, Kansas City, Mary V, Mountain Lion, Ophir-Senator Hill, Rusty Dime, Sac & Fox, and West End.

Sugar Loaf district.—Fourteen properties in the Sugar Loaf district in 1931 produced bullion from small hand mortars and 438 tons of gold ore, the combined bullion and ore carrying 610.03 ounces of gold and 385 ounces of silver; the recoverable content is estimated at 495.41 ounces of gold, valued at $10,241, and 324 ounces of silver, valued at $94 (a total of $10,335). Producing properties were the Dime, Dolly Varden, Gladys, Gold Brick, Grand Republic group, Livingston Dike group, Logan, Nancy-Gray Copper group, Orphan Boy, Paymaster, Poorman-Relief group, Sparkling Jewel, Three Brothers, and Wood Mountain group.

Ward district.—Small lots of ore from 10 properties in the Ward district in 1931 aggregated 39 tons and contained 100.83 ounces of gold and 617 ounces of silver. Producing properties were the Alcyone, B & M mill dump, Captain Jack, Golden Slipper, Idaho, Last Chance, Queen, Struggler, Wilson, and Yellow Bird.

CHAFFEE COUNTY

Browns Canyon district (*Salida*).—Several groups of placer miners sluiced gravel in Browns Canyon or in the Arkansas River near Browns Canyon 17 miles north of Salida and shipped small quantities of placer gold which varied in fineness; that of Renshaw and Mitchell averaged 0.836 in gold and 0.158 in silver.

Chalk Creek district (*Romley, St. Elmo*).—No production was made from the Chalk Creek district in 1931.

Free Gold district (*1 mile north of Buena Vista*).—Chas. Derillo, who for several years has been sluicing gravel from the Arkansas River bars near Buena Vista, deposited in 1931 at the Denver Mint 11.14 ounces of placer gold which after being melted weighed 10.21 ounces and averaged 0.846 fine in gold and 0.148 fine in silver.

Granite district.—In 1931 the general merchandise store at Granite exchanged merchandise for 53.32 ounces of placer gold mined in the vicinity; the bullion when melted at the Denver Mint weighed 49.48 ounces and averaged 0.829 fine in gold and 0.155 fine in silver. In addition, Leroy Vorhees sluiced 1,057 cubic yards between July 1 and November 1 from the "Jones-Webster Placer" and recovered 13.24 crude ounces of placer gold, which after being melted at the Denver Mint weighed 12.13 ounces and averaged 0.841 fine in gold and 0.151 fine in silver; he received $211.51 for his bullion, indicating an average recovery of $0.20 per yard. The First National Bank of Buena Vista purchased 10.38 ounces of placer bullion, which probably came from the Granite district; after being melted at the Denver Mint the grains weighed 10.36 ounces and averaged 0.798 fine in gold and 0.091½ fine in silver.

At the Granite Tunnel property 2 miles northeast of Granite the H & H Mining Co. continued development work and shipped 38 tons of gold ore to the Golden Cycle mill at Colorado Springs.

Monarch-Garfield district.—There was no production from the Monarch-Garfield district in 1931.

CLEAR CREEK COUNTY

Alice district (*Yankee, Lincoln*).—George A. Reynolds mined 2 tons of gold ore during 4 months operation on his mine; he treated the ore in his stamp mill and received $24.83 for the amalgamation bullion produced. Harry White cleaned up some tailings from the Alice and Anchor mills and recovered a small retort of gold, for which he received $66.

Empire district.—Six mines in the Empire district produced 308 tons of ore yielding 290.73 ounces of gold and 10 ounces of silver. Producing mines were the Atlantic, Benton, Gold Dirt, Mint, Portland, and Silver Mountain.

Griffith district (*Georgetown-Silver Plume*).—In 1931 there was only one producing mine in the Georgetown-Silver Plume district—the Centennial; it was operated by the Western States Mining Co., which ran its flotation mill for a short time and produced 29 tons of copper-lead-silver-gold concentrates.

Idaho Springs district.—Nineteen lode mines in the Idaho Springs district produced 13,326 tons of ore yielding $64,849 in gold, 21,638 ounces of silver, 5,055 pounds of copper, and 68,750 pounds of lead, with a total gross calculated value for the four metals of $74,126 compared with 27 mines yielding gold, silver, copper, lead, and zinc valued at $111,588 in 1930. Important producing mines in 1931 were the Black Eagle, Chicago, Kobold, Lincoln, Mattie, and West Gold.

Individual placer miners between Floyd Hill and Fall River recovered $703 in gold and 7 ounces of silver by panning and rocking on the bars of Clear Creek and, in several cases, by making small wing dams and sinking into the bed of the creek with carefully lagged shafts from which the water was pumped by various contrivances, the gravel being raised to sluice boxes.

Montana district (*Lawson, Dumont*).—Only 25 tons of ore were shipped out of the Montana district in 1931—8 tons from the reopened Specht mine and 17 tons from a mill-site clean-up.

Trail Creek district (*Lamartine, Freeland*).—The Tri-State Development Co. extracted from the New Era several hundred tons of ore, the milling of which yielded 88 tons of lead-[zinc]-silver-gold concentrates.

COSTILLA COUNTY

Plomo (*or Rito Seco*) *district.*[3]—In the spring and summer of 1931, 20 churn-drill holes of various depths, mostly 90 feet and under but several over 90 feet, were drilled on the surface outcrop of the gold-bearing rhyolite flow on Rito Seco.

CUSTER COUNTY

Hardscrabble district (*Westcliffe, Silver Cliff*).—Fifteen tons of gold-bearing oxidized ore from the Contact-Hector group were treated in a small arrastre in 1931. The resulting amalgam bullion weighed 51.08 crude ounces; after being melted at the Denver Mint it weighed 50.90 ounces, with a fineness of 0.663 in gold and 0.353 in silver. A lessee on the Passiflora mine shipped 24 tons of lead-silver ore to the Leadville smelter.

DENVER COUNTY

It has been difficult to segregate the deposits of gold from panning and rocking within the bounds of the city and county of Denver. Many people were thus engaged during 1931 on the Platte River and some of its tributaries, between its junction with Cherry Creek (in the heart of the city of Denver) and Englewood, Arapahoe County, and east and south on Cherry Creek in Denver, Arapahoe, Douglas, and Elbert Counties. Those who recovered any gold in these counties naturally gravitated to Denver to sell it to assayers, jewelers, dental-supply concerns, and the Denver Mint. The aggregate of the production of placer gold in Arapahoe, Denver, Douglas, and Elbert Counties is correct, but the separation as to counties is naturally partly estimated. The estimate for Denver County is $598 in gold. Specific deposits known to have been saved within the boundaries of Denver County ranged in fineness from 0.898 in gold and 0.098 in silver to 0.963 in gold and 0.032 in silver.

DOLORES COUNTY

The total gross calculated value of the estimated recoverable gold, silver, copper, lead, and zinc from ore mined and sold from mines in Dolores County in 1931 (all from Rico) was $7,026 compared with $205,486 in 1930 (nearly all from Rico).

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[3] Gunther, C. G., The Gold Deposits of Plomo, San Luis Park, Colo.: Econ. Geol. vol. 1, 1905, pp. 143–154.

Pioneer district (*Rico*).—The only shipments from Rico in 1931 were 42 tons of lead-silver-gold ore from the Union Carbonate mine to the Leadville smelter and 162 tons of zinc-lead-copper-silver-gold ore from the Rico Townsite to the International Smelting Co., Tooele, Utah.

DOUGLAS COUNTY

Douglas County is credited with $808 in placer gold. The known finenesses of placer gold in the county were 0.987 in gold and 0.007 in silver and 0.989½ in gold and 0.005½ in silver.

EAGLE COUNTY

Battle Mountain district (*Red Cliff, Gilman*).—In 1931 the Empire Zinc Co. (New Jersey Zinc Co.) continued until December to operate its 600-ton flotation mill on zinc-lead-silver-iron ore from its Eagle mine at Gilman and throughout the year continued to ship copper-iron-silver-gold ore to Utah smelters and to the Leadville (Colo.) smelter. The zinc concentrates from the mill at Belden were sent to the Mineral Point Zinc Co. (New Jersey Zinc Co.) retort plant at Depue, Ill., and to the Empire Zinc Co. zinc oxide plant at Canon City, Colo.; the lead concentrates went to the Leadville smelter. A 12-ton lot of gold ore was shipped from the Ground Hog mine at Red Cliff to the Golden Cycle mill.

McCoy district.—Tom Morris panned some oxidized gold ore from a prospect 6 miles south of McCoy and recovered several ounces of gold sold to the Denver Mint and 79 pounds of gold concentrates sold to the Leadville smelter.

ELBERT COUNTY

One deposit of placer gold known to have come from Ronk Creek, Elbert County, had a fineness of 0.917 in gold and 0.003 in silver.

EL PASO COUNTY

The Golden Cycle mill at Colorado Springs, El Paso County, treats all the gold telluride ores, containing 0.1125 ounce gold and above, from the Cripple Creek district, Teller County. The mill when built in 1907 was a 1,200-ton roast-amalgamation-cyanidation mill. Since 1927 a supplementary installation of crushers, a ball mill, and a Dorr classifier has been used to treat in an all-sliming cyanidation circuit, without preliminary roasting, gold pyrite ores and concentrates from Leadville, Empire, Idaho Springs, and Russell Gulch; siliceous gold ore from the London mine west of Alma Junction, Park County; siliceous silver ores from Creede; and high-grade specimen gold ore from Summitville. In 1929 crushers, ball mills, and Fahrenwald flotation machines were installed to treat any ores offered, including zincky ores. This addition to the plant began operating in November 1929, and zincky ores were purchased to November 1930. In 1931 the flotation plant was operated chiefly on low-grade sulphotelluride ores from Cripple Creek but also floated out graphitic or carbonaceous gangue material with the lead to make high-grade lead-gold concentrates to eliminate carbon—a cyanicide. The bulk of the ore received was from the Cripple Creek district and, with all the concentrates produced from Cripple Creek ores, went through the regular process of roasting, amalgamation, and cyanidation. Ore from other counties, which did not need flotation to remove cyanicides (such as carbon and copper), was treated by fine grinding and cyanidation. The tailings from all operations (except Cripple Creek ore concentrated) were cyanided.

FREMONT COUNTY

Canon City smelter.—The Empire Zinc Co. (New Jersey Zinc Co.) oxide plant at Canon City continued operation in 1931 on zinc concentrates from the company flotation mill at Hanover, N.Mex., until shortly after the close of the Hanover mill on April 1, and after that on Hanover concentrates in stock and zinc concentrates from the company Eagle mill at Belden, Eagle County, Colo.

GARFIELD COUNTY

Newcastle district.—Assessment work was done in 1931 on the Gray Eagle property near Newcastle.

Rifle Creek district (*Rifle*).—The 140-ton salt-roast, leach, and precipitation plant of the United States Vanadium Corporation (subsidiary of the Union Carbide & Carbon Co.) at Rifle on the Denver & Rio Grande Western Railroad was operated steadily in 1931.

GILPIN COUNTY

In 1931 Gilpin County lode mines produced 262,829 tons of ore yielding $335,210 in gold, 20,783 ounces of silver, 95,000 pounds of copper, and 92,700 pounds of lead, with a total gross calculated value of $353,312, compared with gold, silver, copper, lead, and zinc valued at $162,074 in 1930. Of the total tonnage treated in 1931, 262,697 tons were classified as dry gold ore, 20 tons as dry gold and silver ore, and 112 tons as lead ore. Placer mines in the Rollinsville and Black Hawk districts yielded 154.51 ounces of gold and 24 ounces of silver. Fineness of the Black Hawk bullion when melted at the Denver Mint ranged from 0.795 to 0.870 in gold and from 0.165 to 0.119 in silver, and fineness of the Rollinsville bullion ranged from 0.875 to 0.885 in gold and from 0.119 to 0.090 in silver.

Southern districts (*Black Hawk, Central City, Nevadaville, Russell Gulch*).—The principal producer in the southern districts was the Chain O'Mines, Inc., which operated "The Patch," Roderick Dhu, and San Juan properties at Nevadaville by shrinkage stoping and glory-hole mining. The company amalgamation-gravity concentration-selective flotation mill, which also handled dump material from various other properties in the district, was operated approximately 340 days during the year at an average daily rate of 741 tons. Amalgamation bullion was shipped direct to the Denver Mint. Copper-[zinc]-lead-silver-gold concentrates were shipped to the Leadville smelter and iron-gold-silver concentrates to the Golden Cycle mill at Colorado Springs. The equipment of the Chain O' Mines mill as of December 31, 1931, was as follows: 1 Universal 11 by 18 inch crusher, 1 Farrel 24 by 36 inch crusher, 1 Blake 12 by 24 inch crusher, 1 Symons 4-foot pulverizer, 1 Symons 2-foot pulverizer, 1 Deister 3 by 7 foot by ¾-inch screen, 1 Ruth 4½ by 11 foot rod mill, one 5 by 18 foot tube mill, 1 Colorado Iron Works 6½ by 10 foot ball mill, 1 Allis Chalmers 6 by 7 foot ball mill, 1 Hardinge 8 by 2½ foot ball mill, 2 Akins 5-foot classifiers, 1 Akins 3-foot classifier, 1 Akins 3½-foot classifier, 1 Dorr No. 4 duplex classifier, 20 Wilfley and 9 Deister tables, 2 Ruth 31-inch 12-cell flotation machines, 2 Ruth 21-inch 12-cell flotation machines, 2 Minerals Separation 18-inch 12-cell flotation machines, 1 American 6-foot 4-leaf filter, and 2 Dorr 36 by 12 foot thickening tanks.

Of the other 22 producing lode properties in the southern districts the most important were the Cousin Jack, Gold Cup, Great Mammoth, Pittsburg, and Saratoga. The Gold Patch Mining Co. operated the "Dump" stamp-amalgamation-gravity concentration and flotation mill at Central City for 7 months on ore from the Great Mammoth and Cousin Jack mines. The Ute Gold Mining Co. operated its amalgamation and flotation mill part of the year on dump material from the Pittsburg mine. Lead-sliver-gold ore was shipped from the Gold Cup mine both to the Leadville smelter and to the Golden Cycle mill. At the Saratoga mine the shaft was sunk an additional 130 feet and about 1,200 feet of drifts and crosscuts were run, making a total development at the end of the year as follows: A vertical shaft, 285 feet; drifts, 1,500 feet; and crosscuts, 2,500 feet.

At Black Hawk near the Colorado & Southern Railway station the Eugene Mines, Inc., and lessees sank a cribbed shaft alongside Clear Creek and drifted to bedrock. Gravel, black sand, and old tailings encountered in this shaft were sluiced; the resulting amalgam was shipped to the Denver Mint. The black sand was concentrated on gravity concentration tables and shipped to the Golden Cycle mill at Colorado Springs.

Northern districts.—The lode mines in the northern districts in 1931 produced 7,221 tons of ore yielding $26,467 in gold, 214 ounces of silver, and 400 pounds of lead, with a total gross calculated value of $26,544, compared with 407 tons of ore yielding gold, silver, and copper valued at $5,839 in 1930. The increased output in 1931 resulted from reopening of the Perigo mine and remodeling of the Perigo 30-ton amalgamation-concentration mill in Gamble Gulch near Rollinsville. Other producing lode mines in the district were the Grace, Lone Star, Newport, and Palace. Producing placer mines in the district were the Bergstrom, Fontleroy, Rollins, and Reed in Gamble Gulch.

GRAND COUNTY

No production of metals was made in Grand County in 1931. Prospects in the county were reviewed briefly in the 1929 report of this series.

GUNNISON COUNTY

Cochetopa (*Parlin*) *district.*—In 1931 John H. Fox reopened the Maple Leaf mine 8 miles north of Parlin. The property has a 650-foot vertical shaft, and 30 feet of drifting were done in 1931. The 25-ton mill—ball mill and plates—was operated from June through September; the amalgam bullion produced, after being melted at the Denver Mint, had a fineness of 0.780 in gold and 0.190 in silver.

Domingo (*Goose Creek, White Earth*) *district* (*Madera, Powderhorn, Spencer, Vulcan*).—Assessment work was done at the Great American Nos. 1–9, 9 miles south of Iola. At its property near Powderhorn in sec. 21, T. 47 N., R. 2 W., 15 miles north of Iola, the Gunnison Gold Mines, Inc., drove 250 feet of crosscut adit, making the total development 320 feet of adit, 6 opencuts, and a shaft 65 feet deep; surface improvements were also made. The Economy Mining & Milling Co.

in 1931 unwatered the Old Lott mine, idle for 32 years, and built a small flotation mill at the mine. The property 12½ miles south of Iola is opened by a 323-foot vertical shaft and by 1,500 feet of drifts. The mill was operated at an average rate of 4 tons per day for 8 days, but the concentrates produced were not sold.

Gold Brick district (*Ohio*).—Cameron, Lindblad, and Robinson shipped to the Leadville smelter from the Gold Monument 14 tons of gold-silver ore carrying a little lead. John Satterstrum shipped 35 pounds of specimen gold ore from the district to the Omaha (Nebr.) smelter. At the Carter mine, opened by an 8,800-foot adit, a 1,200-foot shaft, and 10,000 feet of drifts, only repairs and retimbering were done in 1931; the 20-stamp 90 to 100 ton amalgamation-concentration mill was not operated.

Quartz Creek district (*Pitkin*).—The Roosevelt Mines & Electric Co. reports that at the end of 1931 its crosscut adit had a total length of 5,491 feet. No work was done on the adit in 1931, all operations being confined to reconstruction of the wood-stave pipe, 6,625 feet long and 4 feet in diameter, for the hydroelectric plant. The 50-ton amalgamation-concentration mill was not operated.

Rock Creek district (*Marble*).—The Skyline Mining Syndicate did development and prospecting only on its claims in sec. 6, T. 12 S., R. 87 W.

Taylor Park district.—Ben R. Kobey shipped 19 tons of lead-silver-gold ore from the old Enterprise mine. Various placer miners in Taylor Park in 1931 produced $593 in gold and 7 ounces of silver. The fineness of the placer gold in the district ranged from 0.736¾ in gold and 0.260 in silver to 0.865½ in gold and 0.192½ in silver.

Tomichi district (*White Pine*).—Towne & Clemens shipped 118 tons of oxidized lead-silver ore, of which 24 tons went to the Leadville smelter and 94 tons to the Midvale (Utah) smelter.

HINSDALE COUNTY

Cimarron district.—In 1931 at the Silver Jack mine 45 miles southeast of Montrose in sec. 36, T. 45 N., R. 6 W., New Mexico principal meridian, 150 feet of adit were driven; surface improvement work also was done. The property is developed by 2,900 feet of adits.

Lake City district.—A 2-ton lot of gold-silver ore was shipped from the Golconda mine to the Leadville smelter, and a 9-ton lot of gold ore from the Golden Wonder mine to the Golden Cycle mill at Colorado Springs. At the Empire Chief-Highland Chief group 245 feet of adit drifts were driven in 1931, making the total length of this adit 2,044 feet. Other development is a crosscut 600 feet long 845 feet above the level of this main adit.

JEFFERSON COUNTY

A deposit of placer gold definitely known to have been washed from Clear Creek near Golden weighed 2.02 crude ounces at the Denver Mint; when melted it weighed 1.91 ounces and averaged 0.831 fine in gold and 0.163½ fine in silver.

LAKE COUNTY

In 1931 Lake County produced 24,912 short tons of ore yielding, in terms of recovered metals, gold, silver, copper, lead, and zinc having a total gross calculated value of $458,884, compared with

131,202 tons of ore and $2,161,628 in 1930; $353 in gold was also recovered from placer mines in 1931. Lake County also produced 434,104 short tons of molybdenum ore yielding 2,473 tons of molybdenum sulphide concentrates containing 2,644,399 pounds of elemental molybdenum and shipped 3,685 long tons of ferruginous manganese ore to steel mills.

LEADVILLE DISTRICT [4]

GENERAL FEATURES

In 1931 the production of metal (except molybdenum) in Lake County came from the Granite, Leadville, Red Mountain, and Twin Lakes districts, but as usual the bulk of the production was from the Leadville district.

Twenty-six mines in the Leadville district produced 24,888 tons of ore yielding, in terms of recovered metals, $102,955 in gold, 81,145 ounces of silver, 33,308 pounds of copper, 2,939,214 pounds of lead, and 5,773,000 pounds of zinc, with a total gross calculated value of $457,643.

Only one of the three furnaces of the A. V. lead bullion-leady copper matte smelter of the American Smelting & Refining Co. was operated in 1931, and that intermittently. All the ores and concentrates treated in 1931 came from Colorado mines. As has been the situation for several years, this plant has had to depend partly on slag from old smelter dumps carrying a little silver and lead. The quantity of such slag used in 1931—5,615 tons—came from the American, Union, and Western Zinc Oxide Co. dumps.

The Leadville Zinc-Lead Co. 310-ton selective flotation mill, which ceased production December 31, 1930, was idle in 1931.

As usual some of the ores mined at Leadville were shipped for treatment elsewhere. Specimen gold went to the Denver Mint; pyritic gold ores were shipped to the nonroast cynidation department of the Golden Cycle mill at Colorado Springs; and zinc-lead-silver sulphide ores went to the pigment plant at Coffeyville, Kans.

Panning and sluicing in 1931 on the Ball, Leadville Land & Water Co., Wells & Moyer, and Thomas Starr placers yielded 15.34 fine ounces of gold. The fineness of the Ball placer was 0.829½ in gold and 0.161½ in silver; of the Leadville Land & Water Co. placer, 0.788 in gold and 0.207 in silver; of the Wells & Moyer placer, 0.809 in gold and 0.165 in silver; and of the Thomas Starr placer 0.801 in gold and 0.172 in silver.

MINES REVIEW

Producing lode mines in the Leadville district in 1931 were the Adelaide, Dolly B, Evening Star, Fanny Rawlings, Golden Eagle, Ibex, Leadville Deep Mines Co. group, Lilian, New Monarch, Printer Boy, Resurrection, Robert Emmet, St. Louis Tunnel, Tribune, and Venir.

OTHER DISTRICTS

Granite district.—From the old Belle of Granite property in Lake County, near Granite, Chaffee County, 21 tons of gold ore were shipped to the Golden Cycle mill. Two miners were employed 302 days, in 8-hour shifts, prospecting and developing the Yosemity group; a small test lot of gold ore was shipped to the Golden Cycle mill.

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[4] For geology, history, and production see Emmons, S. F., Irving, J. D., and Loughlin, G. F., Geology and Ore Deposits of the Leadville Mining District, Colo.: U.S. Geol. Survey Prof. Paper 148, 1927, 368 pp. Behre, C. H., Jr., Revision of Structure and Stratigraphy in the Mosquito Range and the Leadville District, Colo.: Proc. Colorado Sci. Soc., vol. 12, 1929, pp. 37–57.

Red Mountain district.—A 2-ton lot of lead-silver-gold ore from the Anchor prospect in the Red Mountain district was shipped to the Leadville smelter.

Tenmile (*Climax, Fremont Pass*) *district.*—In 1931 the Climax Molybdenum Co. mill at Climax on Fremont Pass treated 434,104 tons of molybdenum ore yielding 2,473 tons of molybdenum sulphide concentrates containing 2,644,399 pounds of elemental molybdenum. Mining is by the shrinkage-stope system and caving.[5] In March 1931, the company connected its Phillipson tunnel with the shaft sunk near the portal of the White tunnel and blocked out ore on the Phillipson level, while continuing extraction of caved ore above the White level. Ore encountered in development work on the Phillipson tunnel was also treated in the mill. The equipment of the mill was described in the 1929 report of this series.

Molybdenum production at the Climax mill in Colorado, 1924–31

	Elemental molybdenum (pounds)
1924 (idle first 7 months; operated last 5 months)	156, 935
1925	821, 757
1926	1, 057, 367
1927	1, 858, 228
1928	2, 957, 845
1929	3, 529, 295
1930	3, 083, 000
1931	2, 644, 399
	16, 108, 826

Twin Lakes district.—A 1-ton lot of gold ore was shipped from the Eureka mine to the Golden Cycle mill. A small lot of bullion was sold to the Denver Mint from the Gordon-Tiger mill clean-up.

LA PLATA COUNTY

Within the boundaries of La Plata County are the California (La Plata), Cave Basin, Needle Mountain, and Oro Fino mining districts. At Durango is the American Smelting & Refining Co. lead bullion and leady copper matte smelter, equipped with one blast furnace. It handles mainly concentrates but also whatever ore is offered from Dolores, La Plata, Ouray, San Juan, and San Miguel Counties, with occasional lots of ore from Mineral, Lake, and Eagle Counties. The smelter also owns the sulphating plant originally built there by the Complex Ores Recoveries Co. (or Read-Coolbaugh) in 1923 to remove the zinc from the Black Bear (Upper San Miguel district, San Miguel County) bulk concentrates; after the Black Bear operations ceased the American Smelting & Refining Co. acquired the sulphating plant and adjusted it to remove the zinc from other zinc-bearing material, particularly zinc-lead middlings from the Sunnyside mine at Eureka. The zinc sulphate produced has been sold in recent years as a sulphating reagent. The smelter and sulphating plant were closed November 30, 1930.

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[5] Coulter, W. J., Mining Molybdenum Ore at Climax, Colo.: Eng. and Min. Jour., vol. 127, no. 10, Mar. 9, 1929, pp. 394–400; Crushing and Concentrating Molybdenum Ore at Climax, Colo.: Eng. and Min. Jour., vol. 127, no. 12, Mar. 23, 1929, pp. 476–480. Butler, B. S., and Vanderwilt, J. W., The Climax Molybdenum Deposit of Colorado, with Section on History, Production, Metallurgy, and Development, by C. W. Henderson: Proc. Colorado Sci. Soc., vol. 12, 1931, pp. 309–353.

California (or La Plata) district (Hesperus, La Plata).—Ten mines in the California district produced 404 tons of ore yielding 616.88 ounces of gold, 2,317 ounces of silver, and 190 pounds of lead, with a total gross calculated value of $13,431. The principal producer was the May Day, which shipped gold-silver ore to the Golden Cycle mill. Among the other producers of 1 car or less were the Comstock, Idaho, Little Nona, Lost Lode, and Mountain Lily.

MESA COUNTY

Sinbad district.—At the Precipice prospect 65 miles southwest of Whitewater $2,000 was spent in prospecting and development in 1931.

MINERAL COUNTY

Creede district.—No production was made in the Creede silver district in 1931, and no development work was done.

MOFFAT COUNTY

Douglas Mountain district.—A lessee on the Garfield-Bromide group in secs. 9 and 16, T. 7 N., R. 101 W., shipped 34 tons of copper-silver oxidized ore to the Garfield (Utah) copper plant. The ore was trucked 106 miles north to the Union Pacific Railroad at Rock Springs, Wyo. The mine is opened by a 250-foot vertical shaft and 1,375 feet of drifts on three levels.

Timberlake Gulch district (Fourmile Creek).—Three placer mines on Timberlake Gulch or Fourmile Creek several miles south of Baggs, Wyo., and one placer near Great Divide (presumably on the Timberlake watershed) yielded 8.47 fine ounces of gold in 1931. The yield of one, the Jack Pot, had a fineness of 0.918½ in gold and 0.068 in silver. The fineness of the Gooldy was 0.938 in gold and 0.046½ in silver, that of the Grub Stake was 0.915 in gold and 0.062½ in silver, and that of the Zimmerman Bros. at Great Divide was 0.938¾ in gold and 0.056 in silver. The Grub Stake, worked by Wm. McLaughlin, is in secs. 23 and 26, T. 12 N., R. 91 W., sixth principal meridian.

MONTROSE COUNTY

Four placer mines—sluices on bench gravel on the San Miguel River below Naturita—in 1931 recovered 18.19 fine ounces of gold and 7 fine ounces of silver. Deposits were made both at the Denver Mint and at the Salt Lake assay office. Those at the Denver Mint had a fineness of 0.723 in gold and 0.237 in silver, whereas those at the Salt Lake assay office ranged from 0.755 to 0.744 in gold and averaged 0.240 in silver.

OURAY COUNTY

Red Mountain district.—At the Barstow mine 900 feet of development work were done in 1931; at the Magnet, 50 feet; and at the Yankee Girl and San Antonio, a short length of drift.

Ridgway district.—Small sluicing operations near Dallas and Ridgway recovered 5.13 ounces of gold in 1931.

Sneffels district.—The King Lease continued operation on the upper workings of the Camp Bird mine and operated both the mine and mill 365 days. The equipment of the King Lease mill was given in the 1929 report of this series. The amalgam bullion in 1931 assayed 0.736 fine in gold and 0.239 fine in silver. The concentrates made in 1931 were classified as lead-copper, with the principal value in gold, but they also carried nearly seven times as much silver as gold and a considerable quantity of zinc; the zinc naturally was not saved at the Leadville smelter. Development work in 1931 consisted of 460 feet of raises, 268 feet of drifts and crosscuts, and 124 feet of shafts. A brief history of the operations of the Camp Bird mine was given in the 1929 report of this series. Other producers in the district—all small—were the Alma, Last Chance, and Trust-Ruby. At the Valkyrie group 50 feet of adit were driven in 1931, making the total length of the adit 1,000 feet.

Uncompahgre district (*Ouray*).—The American Lease, Inc., drove 300 feet of development work on the Wanakah mine and shipped 20 tons of gold ore to the Leadville smelter in 1931. The Banner American Mining Co. drove 840 feet of development work on the Pony Express group and extracted 2,000 tons of ore; the ore was treated during a 3-month operation of the newly completed 100-ton selective flotation mill. Power was supplied by a Diesel plant completed during the year. The company also drove 1,000 feet of development on the upper Bachelor group. J. Davis and Harve Isreal sank a 22-foot shaft and 15 feet of adit (making the total length 150 feet) on the Sunnyside prospect on Corbett Creek and shipped 20 tons of gold-silver ore to the Golden Cycle mill. The Mutual Gold Mines Co. shipped gold ore to the Leadville smelter as a result of a clean-up at its mill. Development work was done on the Calliope prospect.

PARK COUNTY[6]

Sixteen mines in Park County in 1931 produced gold, silver, copper, and lead valued, in terms of recovered metals, at $910,822, of which $871,789 was in gold. Fifteen lode mines produced 11,497 tons of ore containing 42,504.75 ounces of gold, 29,239 ounces of silver, 25,998 pounds of copper, 866,839 pounds of lead, and 720,712 pounds of zinc. A placer mine produced 6.49 crude ounces of bullion which when melted at the Denver Mint weighed 6.29 ounces, with a fineness of 0.827 in gold and 0.167 in silver.

Buckskin district (*Alma*).—Gold-silver ore was shipped to the Golden Cycle mill in 1931 from the following properties: Excelsior, 7 tons; Gold Bug, 2 tons; and Wyandotte, 2 tons. Development work was done on the Alma Gold Corporation group, Loveland Mountain group, May Queen, and Sweet Home.

Consolidated Montgomery district (*Alma*).—At the Weber group drifting by the Alma Syndicate, Inc., totaled 500 feet in 1931; 14 tons of lead-silver-gold ore were shipped to the Leadville smelter.

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[6] For geology see Singewald, Q. D., and Butler, B. S., Preliminary Geologic Map of the Alma Mining District, Colo.: Proc. Colorado Sci. Soc., vol. 12, no. 9, 1930, 14 pp. See also Patton, H. B., Hoskin, A. J., and Butler, G. M., Geology and Ore Deposits of the Alma District, Park County, Colo.: Colorado State Geol. Survey Bull. 3, 1912, 284 pp. See also Emmons, S. F., Irving, J. D., and Loughlin, G. F., Geology and Ore Deposits of the Leadville Mining District, Colo.: U.S. Geol. Survey Prof. Paper 148, 1927, 368 pp.

Hall Valley district (*Webster*).—Eighteen tons of gold-silver-copper-lead-zinc-bismuth ore were shipped in 1931 from the Missouri mine in the Hall Valley district. Settlement was made at the Midvale (Utah) plant for the gold, silver, copper, and bismuth.

Horseshoe district.—A 2-ton lot of dry gold ore from the Hilltop and a 1-ton lot of silver ore from the Louisville property were shipped to the Golden Cycle mill at Colorado Springs in 1931.

Mosquito district (*Alma*).—In 1931 the Mosquito mining district was not only the most important district in Park County but one of the most important gold-producing districts in the State. Four mines—the American, London, London Extension, and Orphan Boy—shipped 11,408 tons of ore containing 42,393.79 ounces of gold, 26,115 ounces of silver, 22,782 pounds of copper, 857,045 pounds of lead, and 718,944 pounds of zinc.

At the American 268 feet of vertical shaft, 155 feet of crosscuts, 77 feet of inclined winzes, and 259 feet of drifts were driven in 357 days of operation; the total development is reported as 368 feet of vertical shaft and 414 feet of drifts. At the London proper 6,230 feet of development and at the London Extension 578 feet of development were done by the London Gold Mines Co. which operated both; from the London proper 8,640 tons of ore and from the London Extension 289 tons of ore were shipped. From the Orphan Boy 845 tons of ore were shipped; the property is opened by a 1,500-foot adit and 5,000 feet of drifting, of which 200 feet were done in 1931. The Alma Mining & Milling Co. shipped 17 tons of ore from the upper levels of the London proper from an adit on the north side of London Mountain, generally called the North London operation. The North London amalgamation-concentration-flotation mill was idle in 1931. The London proper and the London Extension are operated through what is called the "London Extension Tunnel," driven into the south side of London Mountain.

PITKIN COUNTY

The total gross calculated value of the output of gold, silver, copper, and lead, in terms of recovered metals, in Pitkin County in 1931 was $23,076, compared with gold, silver, and lead valued at $65,074 in 1930.

Avalanche Creek district (*Carbondale*).—Thirteen tons of lead-silver ore were shipped from the Avalanche Creek district to the Midvale (Utah) smelter in 1931.

Independence district.—From the old Independence district, in sec. 12, T. 11 S., R. 83 W., sixth principal meridian, reopened in 1931, a small bar of gold bullion, containing 7.33 fine ounces of gold, and 43 tons of ore, containing 78.39 ounces of gold, 150 ounces of silver, and 1,163 pounds of copper, were shipped.

Roaring Fork district (*Aspen*).—In 1931 the Aspen district produced 3,958 tons of ore yielding, in terms of recovered metals, 37,007 ounces of silver and 271,800 pounds of lead, with a total gross calculated value of $20,789. Lead-silver smelting ore was shipped to the Leadville smelter from the Durant, Durgen, and Spar groups. The Midnight 50-ton flotation mill, completed and set in operation late in 1930, was operated at an average daily rate of 20 tons for 175 days in 1931 and produced 195 tons of lead-silver concentrates containing

33,666 ounces of silver, 210,547 pounds of lead, and 34,800 pounds of zinc. The equipment of the mill was given in the 1930 report of this series. Development at the Midnight mine in 1931 was 100 feet; the property is opened by a 6,700-foot adit, 1,100 feet of drifts, and a 500-foot vertical shaft.

RIO GRANDE COUNTY

South Mountain district.—Development work by the MarianMining & Milling Co. at the Miser-Guadalupe group, from July to December, totaled 550 feet. A 10-day test of the mill was made. The equipment of this 50-ton mill, built in 1929, comprises 1 Universal crusher, 1 Ruth rod mill, 1 Dorr classifier, 1 Plato concentrating table, 1 Ruth 12-cell flotation machine, and 1 Ruth agitation tank. In 1931 some of the concentrates were amalgamated; the remainder were shipped to the Golden Cycle mill.

Summitville district.—Several small specimens of gold were shipped from the Summitville district in 1931, chiefly from the Little Annie mine. Thorough examination of this mine was made by the International Mining Corporation of New York, but after sampling the company dropped its option.

ROUTT COUNTY

Clark district.—Lessees on the Arizona Bar claim at Clark sluiced out 7.94 ounces of placer gold, which after being melted at the Denver Mint weighed 7.62 ounces averaging 0.600 fine in gold and 0.300 fine in silver. Assessment work was done on the Fall River-Slavonia lode mine.

Hahns Peak district.—The Hahns Peak Gold Mining & Milling Co. in 1931 did its annual assessment work, including 40 feet of vertical shaft, track repairs on the Southern Cross adit, and 15 feet of adit, on its group near Columbine. The property is opened by 3½ miles of adits, raises, drifts, and winzes. The mill, idle in 1931, is equipped with one 6-cell flotation machine and three usable concentrating tables. There were no operations at the Master Key property in 1931.

SAGUACHE COUNTY

The total gross calculated value of the output of gold, silver, copper, and lead, in terms of recovered metals, from ores mined in Saguache County was $3,350 in 1931 compared with $417,426 in 1930 and $1,241,209 in 1929.

Crestone district.—A 1-ton lot of dry gold ore to the Leadville smelter and a 1-ton lot of dry gold ore from the Independence mine to the Golden Cycle mill were shipped from the Crestone district in 1931.

Kerber Creek district (*Bonanza*).[7]—The only shipment from the Kerber Creek district in 1931 was a clean-up of 95 tons of lead-copper-silver material from the Rawley mill sent to the Leadville smelter.

Orient district (*Villa Grove, Mineral Hot Springs*).—On the eastern side of the San Luis Valley east of Villa Grove and Mineral Hot Springs is the Colorado Fuel & Iron Co. Orient iron mine, from which iron oxide ore goes to the company iron and steel mill at Pueblo.

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[7] Burbank, W. S., Geology and Ore Deposits of the Bonanza Mining District, Colo., with Section on History and production by C.W. Henderson: U.S. Geol. Survey Prof. Paper 169, 1932, 166 pp.

SAN JUAN COUNTY

Animas district (*Silverton*).—Mining activity in San Juan County in 1931 was confined almost entirely to Arrastra Gulch and vicinity. The Iowa Tiger mine in Silver Lake Basin was operated from January 1 to the middle of August 1931, but its mill in Arrastra Gulch was operated only from January 1 to the middle of May. A 25-ton lot of lead-silver-gold ore was shipped from the Ezra R mine to the Leadville smelter. The bulk of the production of the county came from the Shenandoah-Dives mill whose equipment was described in the 1930 report of this series. To meet the decreased prices for silver, copper, and lead, the management increased the milling capacity by refinements in practice and by increasing drill shifts at the mine to break increased tonnage. Results in 1930 and 1931 are compared in the following table.

Content of ore and concentrates and operating costs at Shenandoah-Dives mine, Silverton, Colo., 1930–31

	1930 (100,141 tons)		1931 (170,795 tons)	
	Metal content and value per ton	Percent of content and value	Metal content and value per ton	Percent of content and value
Ore:				
Gold____ounce per ton__	0. 195	100. 0	0. 196	100. 0
Silver____do____	3. 409	100. 0	2. 929	100. 0
Lead____percent__	. 370	100. 0	. 349	100. 0
Copper____do____	. 701	100. 0	. 500	100. 0
Total value per ton____	[1] $7. 31	100. 0	[1] $5. 98	100. 0
Tailing:[2]				
Gold____ounce per ton__	0. 018	9. 2	0. 017	8. 7
Silver____do____	. 540	15. 8	. 536	18. 3
Lead____percent__	. 051	13. 8	. 056	16. 0
Copper____do____	. 073	10. 4	. 067	13. 4
Total value per ton____	[1] $0. 80	10. 94	[1] $0. 66	11. 0
Concentrate:[2]				
Gold____ounce per ton__	0. 177	90. 8	0. 179	91. 3
Silver____do____	2. 869	84. 2	2. 393	81. 7
Lead____percent__	. 319	86. 2	. 293	84. 0
Copper____do____	. 628	89. 6	. 433	86. 6
Total value per ton____	[1] $6. 51	89. 1	[1] $5. 32	89. 0
Marketing cost (freight and treatment)[2]____	$1. 88	25. 7	$1. 34	22. 4
Net smelter returns [2]____	4. 63	63. 4	3. 98	66. 6
Operating expense [2]____	4. 22	57. 8	3. 30	55. 2
Operating margin [2]____	. 41	5. 6	. 68	11. 4
Average concentrate assay:[3]				
Gold____ounce per ton__	3. 107	____	3. 801	____
Silver____do____	50. 280	____	50. 840	____
Lead____percent__	5. 590	____	6. 240	____
Copper____do____	11. 000	____	9. 210	____
Total value per ton____	[1] $114. 14	____	[1] $112. 99	____

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[1] Calculated at following prices:

	1930	1931
Gold____per ounce__	$20. 6700	$20. 6700
Silver____do____	. 3618	. 2854
Lead____per pound__	. 0538	. 0419
Copper____do____	. 1184	. 0798

[2] In terms of original ore.

[3] In 1930 there were 5,714 dry tons of concentrates produced at a ratio of 17½ to 1; in 1931, 8,041 tons at a ratio of 21.20 to 1.

Operating costs of Shenandoah-Dives Mining Co., Silverton, Colo., in 1931, by departments

Department:	Cost per ton
Mining development	$0. 5443
Mine operation	1. 6024
Mill operation	. 9041
Tramway operation	. 1313
General expense	. 1215
Total operating expense	3. 3036

Eureka district (*Eureka, Silverton*).—The only production from the Eureka district in 1931 was a small bar of gold bullion from the Gold King group. The 1,000-ton Sunnyside mill, closed September 30, 1930, remained idle throughout 1931. The only work at the property in 1931 was the beginning of a new adit at Midway to cut slightly under ore blocked out and partly broken in the stopes extending 600 feet below the Terry tunnel. The new adit was driven about 1,000 feet in 1931, when all work ceased. The equipment of the mill was described in the 1930 report of this series.

SAN MIGUEL COUNTY

Lode mines and several small placer mines in San Miguel County in 1931 produced, in terms of recovered metals, gold, silver, copper, and lead with a total gross calculated value of $55,651, compared with $165,538 (all from lode mines) in 1930.

Iron Springs district (*Ophir*).—The Ophir district in 1931 produced, in terms of recovered metals, $9,341 in gold, 8,124 ounces of silver, 5,395 pounds of copper, and 181,892 pounds of lead, with a total gross calculated value of $18,918, compared with $125,287 in 1930. Only two mines—the Carbonero and Shoemaker—made a production worthy of mention.

Lower San Miguel district (*Sawpit, Vanadium*).—Small lots of specimen gold and a 1-ton lot of gold ore from Placerville totaled 7.79 ounces of gold and 7 ounces of silver. Small panning and sluicing operations near Placerville, principally on the Donegan placer, resulted in a recovery of 11.32 fine ounces of gold. The fineness of the Donegan placer bullion was 0.796 in gold and 0.201 in silver.

Upper San Miguel district (*Telluride*).—Gouging operations within the Smuggler-Union mine, mine clean-ups around the Smuggler-Union mill, and other clean-up work in the Upper San Miguel district resulted in an output of 1,086 tons of ore yielding $35,931 in gold, 1,193 ounces of silver, and 1,596 pounds of lead.

SUMMIT COUNTY

The total gross calculated value of metals recovered from Summit County lode and placer mines was $22,966 in 1931 compared with $141,582 in 1930.

Breckenridge district.—The total gross calculated value of the combined output of lode and placer mines in the Breckenridge district in 1931 was only $21,576.

The Buffalo Exploration & Mining Co. operated the Bemrose-Bostwick placer in Hoosier Gulch near Hoosier Pass 30 working days between June 25 and September 1, using a gasoline power shovel and a drag-line excavator, followed by sluice boxes. During that period

9,000 yards of gravel were handled. The bullion recovered had a fineness of 0.822 in gold and 0.174 in silver after being melted at the Denver Mint. The Continental Dredging Co. operated its electrically driven dredge equipped with 88 buckets, each with a capacity of 8½ cubic feet, from April 25 to June 30, when it was forced to cease dredging on account of inability to reach bedrock. Three months were then spent in drilling and prospecting to determine the content of gravel and depth to bedrock in the ground ahead. It was then decided to add to the number of buckets and to lengthen the digging ladder. Resumption of operations was not expected until April or June 1932. In 1931 this dredge recovered only 356.09 crude ounces, which after being melted weighed 355.83 ounces and had a fineness of 0.750 in gold and 0.192 in silver. The production came from 246,260 cubic yards of gravel. The returns from the mint totaled $5,535.40. Eighteen small panning, sluicing, and hydraulic operations in the district yielded 227.54 fine ounces of gold and 55 ounces of silver.

Production of lode mines in the Breckenridge district was confined to a few tons of gold ore from the Jason group, a 5-ton lot of smelting lead-silver ore from Breckenridge, 1 car of lead-copper-silver-gold ore from the Royal Tiger mine, and bullion from the Royal Tiger mill. The mill was operated exclusively on gold-bearing material from the Cashier group, but only for 90 days during 1931.

Montezuma district.—Production from the Montezuma district in 1931 was limited to a 34-ton lot of lead-silver-gold ore shipped from the Silver King and a 3-ton lot of lead-silver-gold concentrates recovered from a small quantity of ore from the Bullion group treated at the remodeled Bolivar mill.

Ten Mile district (*Frisco, Kokomo, Robinson*).—The only production from lode mines in the Ten Mile district in 1931 was a 4-ton lot of lead-silver-gold ore shipped from the Silver Queen property. Paul Maurer operated the Eureka placer in McNulty Gulch from May 28 to October 14 and extracted 10.99 crude ounces of gold, which after being melted at the Denver Mint weighed 10.61 ounces, with a fineness of 0.854¾ in gold and 0.152½ in silver.

TELLER COUNTY

Mine and dump siliceous sulphotelluride gold ores from the Cripple Creek district in 1931 aggregated in calculated recovered gold 115,398.90 ounces, valued at $2,385,507, and 8,200 ounces of silver, compared with $2,532,032 in gold and 8,691 ounces of silver in 1930. In these calculations account is taken of mill slags, clean-ups, and stolen specimen gold. Such accounting has been made in all previous reports of this series.

In 1931, for the first time in the history of the Cripple Creek district, a production of gold known to have been extracted by placer methods was recorded. Frank Little, a lessee on the Arequa placer, operated a short time (his work being limited to days when it rained or when snow melted) and recovered 13.17 crude ounces, which after being melted at the Denver Mint weighed 11.79 ounces and had a fineness of 0.929 in gold and 0.050 in silver. One other lot, presumably placer, from the Cripple Creek district weighed 2.18 ounces; after being melted, it weighed 2.15 ounces and had a fineness of 0.808 in gold and 0.093 in silver.

In 1931 the Golden Cycle mill at Colorado Springs continued to hold the exclusive market for Cripple Creek ores. The treatment rates for the Cripple Creek district, effective September 1, 1930, follow. These rates were continued throughout 1931.

Cripple Creek treatment rates, Golden Cycle mill, effective September 1, 1930 (in effect during 1931)

Ore up to and including $4 gold per ton	$1.85 plus $0.50 freight.
Over $4 and including $5 gold per ton	$1.85 plus $0.75 freight.
Over $5 and including $8 gold per ton	$2.35 plus $1 freight.
Over $8 and including $10 gold per ton	$4.15 (includes freight).
Over $10 and including $15 gold per ton	$5.45 (includes freight).
Over $15 and including $20 gold per ton	$6.50 (includes freight).
Over $20 and including $25 gold per ton	$6.85 (includes freight).
Over $25 and including $30 gold per ton	$7.40 (includes freight).
Over $30 and including $40 gold per ton	$8.00 (includes freight).
Over $40 and including $100 gold per ton	$9.10 (includes freight).
Over $100 gold per ton	$6.00 plus $3.10 freight.

Freight rate on ores of value over $100 per ton is $3.10 plus 1 percent of value in excess of $100 unless the consignment be released to value not to exceed $100.

Rates subject to change at option of mill manager.

During 1931 the Golden Cycle mill, which since 1907 has been a custom plant for gold ores, since 1927 for gold and silver ores, and since November 1929 for complex sulphide ores, from other parts of the State, consisted actually of three mills: (1) A 1,200-ton roast amalgamation-cyanidation mill; (2) a 40-ton nonroasting all-sliming unit consisting of a sampler, a Marcy ball mill, Dorr classifier, and Dorr thickener and agitating tanks; and (3) a 300-ton selective flotation mill. In 1931 several different flow sheets, including all three mills, were utilized. Some Cripple Creek sulphotelluride ores were floated, the concentrates going to the roaster and continuing through the amalgamation-cyanidation circuit. Tailings from the complex [zinc]-lead-copper-silver-gold ores went into the general cyanidation circuit. Copper in the complex ores was separated selectively into copper concentrates or copper-lead concentrates and thus kept out of the cyanidation circuit. Sulphide gold-silver ores were treated by fine grinding without roasting and went thence into the general cyanidation circuit. Treatment rates for miscellaneous ores and concentrates, as of October 1, 1931, follow:

Treatment rates for miscellaneous ores and concentrates at the Golden Cycle mill, Colorado Springs, October 1, 1931

Ore up to and including $10 [calculated value] per ton	$3. 00
Over $10 and including $15 [calculated value] per ton	3. 50
Over $15 and including $20 [calculated value] per ton	4. 00
Over $20 and including $40 [calculated value] per ton	5. 00
Over $40 [calculated value] per ton	5. 50

An added charge of $5 will be made for sampling all lots of ore containing less than 10 tons, dry weight, and an extra charge of $5 per lot made for each lot when more than one lot in a car.

An added charge of 10 cents per ton made if ore is sacked.

An added charge of 5 cents per ton will be made for each 1 percent moisture in excess of 10 percent.

The above rates are exclusive of freight rates.

Ore containing nonsulphide copper in excess of 0.2 percent will not be accepted for treatment at this plant.

BASIS OF PAYMENTS

Miscellaneous ores:

Gold: No payment for gold when under 0.02 ounce per ton; $19.50 per ounce when 0.02 ounce per ton up to and including 0.50 ounce per ton; $20 per ounce when settlement value exceeds 0.50 ounce per ton.

Silver: No payment for silver when under 1.0 ounce per ton. Market quotations date immediately preceding date of settlement, excluding fractions of cents, unless ore exceeds 100 ounces silver per ton, in which event 2½ cents per ounce additional will be charged for ounces in excess of 100 ounces.

Silver contents:

Pay 50 percent on ore containing 1 ounce and including 5 ounces.
Pay 65 percent on ore over 5 ounces and including 10 ounces.
Pay 75 percent on ore over 10 ounces and including 20 ounces.
Pay 85 percent on ore over 20 ounces and including 50 ounces.
Pay 90 percent on ore over 50 ounces and including 100 ounces.
Pay 95 percent on ore over 100 ounces.

Sulphide lead:

No payment for nonsulphide lead content. No payment when sulphide lead content is under 3 percent.

Wet assay less 1 percent; pay for 80 percent of the remainder at New York quotation less 2½ cents per pound. Market quotations date immediately preceding date of settlement used as basis of payment.

Sulphide copper:

No payment for nonsulphide copper content.

Added to and paid for as lead. No payment when sulphide copper content is under 1 percent. No payment for copper when sulphide lead content is under 3 percent, unless sulphide copper content is 3 percent or over, in which event sulphide copper will be paid for as lead.

Concentrates:

Payment for gold and silver values only.

Gold—$19 per ounce when settlement value is 2.0 ounces or under; $19.50 per ounce when settlement value exceeds 2.0 ounces.

Silver—Subject to payment as above. No payments or penalties made other than as specified above.

All new shippers other than from the Cripple Creek district should send a 10-pound sample of ore for testing before billing shipments.

Rates subject to change at the option of the mill manager.

MINES REVIEW[8]

Mineral Hill.—One car of ore was shipped from the Plutocrat prospect in 1931; but the returns were not satisfactory, and work was stopped. At the Little Ida 62 feet of shaft were sunk and 94 feet of drifting were done; some ore was shipped to the Golden Cycle mill.

Poverty Gulch.—A shipment of 182 tons of ore from the Black Diamond netted $206.

Rhyolite Mountain.—From the Rhyolite Mountain claim the Ellis M. & M. Co. made one shipment of 22 tons of ore, which netted $61.

North Slope of Ironclad Hill.—Production continued from the Damon (Axtel) and W.P.H. groups of the United Gold Mines Co. Statements of tonnages of ore shipped and receipts from all United Gold Mines Co. properties are given at the end of this chapter (see p. 541).

Other producing mines in this area were the Forest Queen, Jerry Johnson, and Pride of Cripple Creek. Ore shipped from the Forest Queen averaged $15.23 in gold per ton; that from the Jerry Johnson group ranged from $4.34 to $5.45 per ton.

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[8] For convenience of study and to continue the record the order of the mines review follows the exact order of the detailed descriptions of mines in Lindgren, Waldemar, and Ransome, F. L., Geology and Gold Deposits of the Cripple Creek District, Colo.: U.S. Geol. Survey Prof. Paper 54, 1906, pp. 271–493.

In the following mines review all reference to content is in ounces of gold or dollars figured at $20 per ounce of gold. Ore from Cripple Creek is assayed for gold only.

Gold Hill.—From the Anchoria Leland 928 tons of ore containing 321 fine ounces of gold were shipped. The mine is operated under the split-check system. Present development consists of a 1,200-foot vertical shaft, 25,000 feet of drifts, and 2,500 feet of tunnels. The Atlas Gold Mining Co. shipped 1,766 tons of ore from the Midget and Bonanza. Small shipments were made from the Comstock and Hilda M. group by the Gold Bond Consolidated Mines Co., from the Moon-Anchor by the Stratton Leasing Co., and from the Ophir by the Ophir Gold Mining Co.

Raven and Guyot hills.—Producing mines were the Cresson, Doctor-Jack Pot dump, Elkton, and Mary McKinney. The annual report of the Cresson Consolidated Gold Mining & Milling Co. for the 12 months ended August 31, 1931 (dated January 10, 1932), and the supplementary report for the 4 months ended December 31, 1931 (dated March 22, 1932), say:

During the fiscal year 62,606 dry tons of ore were shipped on company account of a gross value of $545,141.33, averaging $8.70 gold per ton; the returns, less transportation and treatment of $227,985.06, were $317,156.27, giving the ore a net value of $5.06+ per ton. The company received as additional income the sum of $12,521.66 interest on bank deposits and $84,830.70 net royalty on 17,873 tons lessee ore, making a total of $414,508.63, with total expenses of $312,542.02, resulting in a net gain from operations of $101,966.61.

The operations of lessees through the Cresson shaft were on a split-check lease, that is, 50 percent to company and 50 percent to lessee, after deducting freight and treatment.

The average cost per ton of ore, as shown below as $4.99, is figured only on tonnage of company ore, 62,606, but the cost includes some expense which should be charged against 17,873 tons of lessee ore. Considering costs with this change, they are lower per ton than in 1930.

Costs per ton at the Cresson mine, fiscal year ended August 31, 1931

General expense	$0.004	Mining operations (includes mine management and engineering)	$4.536
Taxes	.097	Depreciation	.008
Insurance	.195		4.990
Salary, officers	.046		
Colorado Springs office	.104		

Total cash and accounts receivable at the close of the fiscal year ending August 31, 1931, were $298,159.84.

Development

	Feet	*Feet*
Drifts and crosscuts:		
Company	6,023	
Lessees	1,528	
		7,551
Raises and winzes:		
Company	837	
Lessees	477	
		1,314
Total		8,865

The development of the past year exceeded that of 1929–30, as did the tonnage of ore shipped.

A large number of small ore bodies have been opened and stoped. The exploratory work on lessee and company account is being carried forward.

The equipment and surface plant of the mine is in good condition.

It was decided by the directors to make the fiscal year end December 31 rather than August. Following are the reports of the treasurer and general manager covering the period of four months, ending December 31, 1931.

During the four months 20,235 dry tons of ore were shipped on company account of a gross value of $139,939.82, averaging $6.90 [gold] per ton; the returns, less transportation and treatment of $67,453.66, were $72,486.16, giving the ore a net value of $3.58 per ton. The company received as additional income the sum of $2,919.47 interest on bank deposits and $32,701.78 net royalty on 6,726 tons lessee ore, making a total of $108,107.41, with total expenses of $104,965.45, resulting in a net gain from operations of $3,141.96.

The operations of lessees through the Cresson shaft were on a split-check lease. The average cost per ton of ore, as shown below as $5.18, is figured only on tonnage of company ore, 20,235, but the cost includes some expense which should be charged against 6,726 tons of lessee ore.

Costs per ton at the Cresson mine, four months ended December 31, 1931

Taxes	$0. 097	Mining operations (includes mine management and engineering)	$4. 700
Insurance	. 200	Depreciation	. 024
Salary, officers	. 046		5. 180
Colorado Springs office	. 113		

* * * * * * *

Following is a summary of the development work for 4 months ending December 31, 1931:

Development

	Feet	Feet
Drifts and crosscuts:		
Company	2, 152	
Lessees	582	
		2, 734
Raises and winzes:		
Company	342	
Lessees	35	
		377
Total		3, 111

Total production, Cresson Consolidated Mining & Milling Co., Colorado, 1903, to December 31, 1931, was as follows: Dry short tons, 1,952,327; gross value, $33,575,145.52; freight and treatment, $10,134,552.30; net value, $23,440,593.22; average gross value per ton, $17.20; average net value per ton, $12.01; dividends, $12,369,072.50.

Beacon Hill.—The following shipments of ore were made from mines on Beacon Hill in 1931: New El Paso, 1,453 tons containing 249 ounces of gold; Dexter of the Hamlet-Dexter Mines Co., 438 tons containing 59 ounces; New Gold Dollar, 226 tons containing $3.68 per ton; and Ramona, 22 tons containing 6 ounces.

Bull Hill.—In 1931 the Stratton shipped 8,447 tons of ore containing $44,997 in gold. All ore was mined by lessees. The Mexican G. & S. Mining Co. operating the Gold Pinnacle group shipped 1,577 tons of ore containing $30,647 in gold. The only other producer on Bull Hill was the Gold Sovereign of the United Gold Mines Co.

School Section 16.—The Kyner Leasing Co. continued operation on the School Section in 1931 and shipped 944 tons of ore containing 606 ounces of gold.

Between Altman and Goldfield.—Producing mines between Altman and Goldfield were the Acacia, Free Coinage, Pharmacist, and United Gold Mines Co. The Acacia, operating the Morning Star and North and South Burns, produced 2,190 tons of ore containing $9,937 in gold, all produced by lessees. The Pharmacist shipped 1,290 tons of ore containing $3.34 in gold a ton. The Doodle Bug Gold Mining Co. operating on the Free Coinage made small shipments.

Battle Mountain.—There were five operating mines on Battle Mountain in 1931—Bonanza (of the United Gold Mines Co.), Granite, Portland, Strong, and Monmouth Investment Co. on the Jefferson. The Portland was the largest producer of ore with 28,388 tons containing $264,936 in gold. The Granite was second in tonnage with 20,503 tons containing $399,792 in gold. The Monmouth Investment Co. on the Jefferson claim shipped 1,089 tons containing $14,464 in gold.

United Gold Mines Co.—The annual report, dated January, 1932, of the United Gold Mines Co., an operating and holding company for property scattered throughout the Cripple Creek district, says:

> The development work done on the property was more than in any previous year—a total of 15,633 feet.
>
> This work did not disclose any new ore of consequence but did enable the company to pay for work and leave a small operating gain.
>
> In several of the mines, old levels were cleared of caves, retimbered, and production made from them.
>
> There remains undeveloped territory, but each year this decreases. However, a small area can contain enough ore to make another Cresson.

* * * * * * *

Total production of property—United Gold Mines Co., 1931

	Net tons	Gross value
Ore mined before consolidation	26, 310	$456, 806. 19
Production under operations of the United Gold Mines Co	952, 099	11, 265, 145. 13
Total to Dec. 31, 1931	978, 409	11, 721, 951. 32

Production of the United Gold Mines Co.—Company ore in 1931

Mine	Net tons	Gross value	Company ore cash receipts	Average gross value per ton	Number of cars shipped
Vindicator	9, 402	$63, 955. 36	$33, 891. 02	$6. 802	300
Rose Nicol (Big Banta, Trail)	8, 467	130, 522. 11	88, 286. 03	15. 416	222
Isabella (Empire Lee)	562	6, 733. 58	3, 970. 97	11. 979	20
Solomon	256	1, 880. 85	777. 94	7. 341	8
	18, 687	203, 091. 90	126, 925. 96	10. 868	550

Production of the United Gold Mines Co.—Lessee ore in 1931

Group	Net tons	Gross value	Royalties received	Tax	Lessees' receipts	Average gross value per ton	Number of cars
Deadwood miscellaneous	3, 499	$11, 650. 21	$437. 47	$110. 42	$2, 448. 81	$3. 33	103
Findley	17, 980	61, 332. 96	1, 856. 05	613. 33	15, 881. 96	3. 41	489
Shurtloff	2, 832	10, 954. 77	384. 53	108. 62	3, 237. 78	3. 86	86
Hardwood	1, 109	10, 548. 50	897. 49	104. 39	5, 001. 54	9. 51	35
Isabella (Empire Lee)	1, 298	10, 609. 69	2, 057. 18	2. 39	2, 897. 92	8. 17	45
Solomon	1, 387	14, 232. 58	3, 604. 19	138. 74	3, 854. 20	10. 26	44
Rose Nicol (Big Banta, Trail)	3, 842	29, 001. 72	6, 862. 56	285. 40	8, 415. 71	7. 54	121
Theresa	11, 904	85, 660. 28	21, 993. 51	814. 00	22, 751. 57	7. 19	377
Vindicator	13, 121	140, 613. 02	40, 831. 82	1, 341. 11	45, 088. 45	10. 71	426
W.P.H	2, 035	11, 105. 02	362. 58	105. 03	3, 234. 33	5. 46	58
Bonanza	416	6, 416. 57	710. 45	63. 35	3, 206. 70	15. 44	14
	59, 423	392, 125. 32	79, 997. 83	3, 686. 78	116, 018. 97	6. 59	1, 798

Development of the United Gold Mines Co. in 1931

	Feet
Vindicator, by the company	2, 139
Vindicator, by lessees	8, 099
Rose Nicol, by the company	3, 389
Solomon, by lessees	914
Isabella, by the company	80
Isabella, by lessees	1, 012
Total	15, 633

GOLD, SILVER, COPPER, LEAD, AND ZINC IN UTAH[1]

(MINE REPORT)

By C. N. Gerry and Paul Luff[2]

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SUMMARY

The output of gold, silver, copper, lead, and zinc from Utah mines in 1931 was valued at $28,970,974, which was less than in any year since 1921 and much less than the annual average ($66,498,420) for the decade 1922 to 1931. In fact, it was only about three fifths the total value in 1930 ($48,653,464) and less than one third that in 1929 ($95,985,201). The output of each of the five metals decreased decidedly. The decrease in output of copper ore from Bingham accounted for nearly half the decrease in total value of metals, and the unusually large decreases in output of lead-zinc ore from the Park City region and in lead ore from the Tintic district accounted for most of the remainder.

Compared with other States Utah was first in output of silver in 1931 (as it has been since 1920), third in copper and lead, fourth in zinc, and fifth in gold. Salt Lake County, which includes the Bingham district, produced 72 percent of the total value of the metal output of the State and again led in production of each of the five metals; Utah County, which includes part of the Tintic district, was second; and Summit County, which includes part of the Park City region, was third.

Since 1864 the output of the five metals in Utah has been as follows: Gold, $139,657,325; silver, 585,475,176 fine ounces; copper, 4,717,106,868 pounds; lead, 6,953,661,198 pounds; and zinc, 865,453,076 pounds. The total value of this output has been $1,784,124,586, and mines in the Bingham district have yielded metals valued at more than half the total.

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[1] Work on manuscript completed October 1932.

[2] Assisted by LaRu Shepherd, of the Bureau of Mines.

Published dividends paid by four mining companies amounted to $10,571,287 in 1931, making a recorded total of $381,046,415 paid to stockholders since mining became profitable in the State. An unusually large part of the total value of the metal output in 1931 and more than 21 percent of that since 1864 were paid in dividends. The dividends shown here for 1931 do not include $2,252,615 paid by the United States Smelting, Refining & Mining Co., which controls mines in other States and in Mexico, besides those at Eureka and Bingham, Utah. The four companies that distributed dividends in 1931 were the Utah Copper, which paid more than 92 percent of the total, Tintic Standard, Silver King Coalition, and Eureka Standard.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–1931

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064	1930	$0.385	$0.130	$0.050	$0.048
1928	.585	.144	.058	.061	1931	.290	.091	.037	.038
1929	.533	.176	.063	.066					

Mine production of gold, silver, copper, lead, and zinc in Utah, 1927–1931, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1927	123	---------	15,757,074	193,908.82	$4,008,451	18,606,950	$10,550,141
1928	121	3	18,427,117	212,559.79	4,394,001	17,072,852	9,987,618
1929	127	3	19,831,975	240,419.63	4,969,915	17,592,396	9,376,747
1930	103	---------	11,041,841	208,455.03	4,309,148	13,129,421	5,054,827
1931	96	9	8,954,617	198,740.12	4,108,323	8,290,966	2,404,380

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1927	256,933,278	$33,658,259	302,570,040	$19,061,913	99,185,443	$6,347,868	$73,626,632
1928	293,235,039	42,225,846	291,830,021	16,926,141	93,857,352	5,725,298	79,258,904
1929	318,282,523	56,017,724	298,754,429	18,821,529	103,019,485	6,799,286	95,985,201
1930	180,526,423	23,468,435	230,989,780	11,549,489	88,990,938	4,271,565	48,653,464
1931	151,236,505	13,762,522	158,423,453	5,861,668	74,581,072	2,834,081	28,970,974

GOLD

Production of gold in Utah in 1931 decreased nearly 5 percent from 1930. Further decrease was prevented by the marked increase in output from the Eureka Standard mine in the Tintic district and from properties operated by the United States Smelting, Refining & Mining Co. in the Bingham district. Nearly 93 percent of the gold came from the Bingham district in Salt Lake County and the Tintic district in Utah and Juab Counties. The output from the Bingham district increased slightly, as the increase from the United States and Niagara mines more than offset the decrease from the Utah Copper, Utah-Delaware, and Utah-Apex properties; the output from the Tintic district decreased nearly 3,000 ounces, as a result of the marked decline in output from the North Lily and Eureka Lilly properties, although production from the Eureka Standard mine increased more than 17,000 ounces. The output of gold from the Park City region decreased more than 12,000 ounces, due chiefly to suspension on March 1 of shipments of lead-zinc ore from the Park Utah mine. More than 36 percent of the total gold was derived from siliceous gold ore and old tailings, nearly 33 percent from copper ore, 24 percent from lead-zinc ore, and most of the remainder from lead ore. The quantity derived from siliceous gold ore and lead-zinc ore increased nearly 28,000 ounces, but that from copper ore and lead ore decreased more than 25,000 ounces.

The Utah Copper property at Bingham was the largest producer of gold in Utah in 1931, but its output was less than in 1930. The Eureka Standard mine near Dividend in the Tintic district was second, and the United States mine at Bingham was third. Other large producers were the Niagara, North Lily, Mammoth, and Utah-Delaware properties.

SILVER

In 1931 Utah was again the largest producer of silver in the United States, but its output was less than in any year since detailed records were started in 1903 and less than half the annual average (16,899,012 ounces) for the decade 1922 to 1931. The quantity of silver decreased nearly 5,000,000 ounces from 1930, chiefly as a result of marked curtailment in output of lead ore and lead-zinc ore. Nearly 40 percent of the total silver in 1931 came from mines in the Tintic district, 30 percent from the Bingham district, and most of the remainder from the Park City region. There was a decrease of more than 2,000,000 ounces in the Park City region, more than 1,500,000 ounces in the Tintic district, and more than 1,000,000 ounces in the Bingham district. The unusually large decrease in the Park City region resulted chiefly from suspension on March 1 of shipments of lead-zinc ore from the Park Utah mine and curtailment in output of lead-zinc ore from the Silver King Coalition mine. There was a general decrease in output of silver from the chief producers in the Tintic district except the Eureka Standard property; the largest decline was recorded in output from the Tintic Standard mine. The decrease in the Bingham district was due chiefly to marked curtailment in output of ore from the Lark group of the United States Smelting, Refining & Mining Co., and from the Bingham Prospect, Utah-Apex, and Utah Copper properties; the output of silver from the United States and Niagara properties increased. Nearly 47 percent of the total silver was derived from lead-zinc ore, more than 29 percent from lead ore, more than 8 percent from siliceous gold ore, 8 percent from copper ore, and 6 percent from siliceous silver ore.

Eight properties in Utah each produced more than 300,000 ounces of silver in 1931—the Tintic Standard, Silver King Coalition, United States (United States Smelting, Refining & Mining Co.), Utah Copper, Eureka Standard, Niagara, Plutus, and Park Utah Consolidated properties.

COPPER

In 1931 Utah was again third among the States as a producer of copper, following Arizona and Montana; its output, however, decreased 29,289,918 pounds in quantity and $9,705,913 in value from 1930. The Utah Copper Co. at Bingham, which produced about 94 percent of the State total in 1931, decreased its output 12 percent compared with 1930, as a result of the general demand of copper producers for curtailment in world output. Nearly 98 percent of the copper produced in Utah in 1931 came from the Bingham or West Mountain district, Salt Lake County. Ores concentrated yielded 140,521,177 pounds of copper and crude ores shipped to smelters 5,274,067 pounds; nearly all the remainder was recovered from mine-water precipitates. Of the copper from crude copper ore smelted, sulphide ores yielded 2,724,679 pounds and oxidized ores 943,287 pounds. Nearly 94 percent of the total recovered copper came from copper ore, largely by concentration.

The leading copper producers in Utah in 1931 were, in order of output, the Utah Copper Co. (which reported 142,694,917 net pounds, a large decrease from 161,138,717 pounds in 1930), Utah-Delaware, United States Smelting, Refining & Mining Co., and Utah-Apex properties.

LEAD

In 1931 Utah again ranked third among the States as a producer of lead, following Missouri and Idaho, but its output decreased more than 31 percent—from 230,989,780 pounds in 1930 to 158,423,453 pounds in 1931. The largest decrease in lead was recorded from lead-zinc ore concentrated; there were also substantial decreases from crude lead ore smelted and from lead ore concentrated. Nearly 62 percent of the total lead in 1931 came from lead-zinc ore and nearly 36 percent from lead ore.

The output of lead from the Bingham or West Mountain district decreased from 85,172,500 pounds in 1930 to 67,193,735 pounds in 1931; nearly 75 percent of it came from the United States and Lark properties and more than half of the remainder from the Niagara mine, all operated by the United States Smelting, Refining & Mining Co. The unusually large decreases from the Lark and Utah-Apex properties more than offset the large increases from the Niagara and United States mines.

The output of lead from the Tintic district (Juab and Utah Counties) decreased considerably—from 58,948,000 pounds in 1930 to 36,853,599 pounds in 1931. Large decreases were reported by the North Lily, Eureka Lilly, and Tintic Standard companies.

The production of lead in the Park City region (Summit and Wasatch Counties) decreased from 61,749,780 pounds in 1930 to 34,736,616 pounds in 1931. The output from the Park Utah Consolidated properties decreased more than 14,000,000 pounds, and there was also an unusually large decrease from the Silver King Coalition mine.

The United States mine of the United States Smelting, Refining & Mining Co. at Bingham was again the largest producer of lead in Utah, followed in order by the Tintic Standard mine in the Tintic district and the Silver King Coalition property in the Park City region; each of these mines produced more than 24.000,000 pounds of lead. Other large producers were the Bluestone Lime & Quartzite, Park Utah Consolidated, Niagara, North Lily, and Utah-Apex properties.

ZINC

The production of zinc in Utah in 1931 was 74,581,072 pounds, a decrease of 14,409,866 pounds from 1930, and the State again ranked fourth in output, following New Jersey, Oklahoma, and Kansas. The Bingham or West Mountain district, Salt Lake County, and the Park City region, Summit and Wasatch Counties, were the chief zinc-producing areas.

The output of zinc from the Bingham or West Mountain district increased from 44,724,792 to 53,215,489 pounds, and in 1931 the district produced more than 71 percent of the State total. The marked increase from the United States and Niagara properties, both operated by the United States Smelting, Refining & Mining Co., more than offset the large decreases from the Lark, Utah-Apex, and Bingham Prospect properties.

The output of zinc from the Park City region decreased decidedly—from 39,085,269 to 18,871,329 pounds. The output from the Park Utah Consolidated properties decreased more than 14,000,000 pounds, and there was also a large decrease from the Silver King Coalition mine.

The large decrease in output of zinc in Beaver County was due to curtailment in output of lead-zinc milling ore from the Horn Silver mine of the Tintic Lead Co.

The United States mine of the United States Smelting, Refining & Mining Co. at Bingham produced nearly 58 percent of the State output of zinc in 1931, followed by the Silver King Coalition mine at Park City, the Niagara mine at Bingham, and the Park Utah Consolidated properties in the Park City region.

Mine production of gold, silver, copper, lead, and zinc in Utah in 1931, by counties, in terms of recovered metals

County	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
Beaver	767.86	$15,873	67,542	$19,587
Box Elder	13.01	269	16	4
Cache			3	1
Garfield	11.08	229	10	3
Grand	3.97	82		
Iron	20.85	431	85	25
Juab	11,545.66	238,670	801,175	232,341
Millard	4.11	85		
Piute	303.80	6,280	2,451	711
Salt Lake	107,021.36	2,212,328	2,522,448	731,510
Sevier	80.01	1,654	254	74
Summit	2,305.02	47,649	1,604,536	465,315
Tooele	4,752.07	98,234	258,886	75,077
Uintah	16.64	344	8	2
Utah	69,157.29	1,429,608	2,513,911	729,034
Wasatch	2,736.04	56,559	519,641	150,696
Washington	1.35	28		
	198,740.12	4,108,323	8,290,966	2,404,380
Total, 1930	208,455.03	4,309,148	13,129,421	5,054,827

Mine production of gold, silver, copper, lead, and zinc in Utah in 1931, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaver	73, 942	$6, 729	1, 035, 168	$38, 301	477, 719	$18, 153	$98, 643
Box Elder	----------	----------	----------	----------	----------	----------	273
Cache	----------	----------	1, 900	70	----------	----------	71
Garfield	281	26	----------	----------	----------	----------	258
Grand	----------	----------	----------	----------	----------	----------	82
Iron	----------	----------	----------	----------	----------	----------	456
Juab	928, 725	84, 514	4, 805, 266	177, 795	675, 270	25, 660	758, 980
Millard	----------	----------	----------	----------	----------	----------	85
Piute	1, 697	154	13, 645	505	835	32	7, 682
Salt Lake	147, 716, 785	13, 442, 227	67, 428, 678	2, 494, 861	53, 228, 506	2, 022, 683	20, 903, 609
Sevier	----------	----------	----------	----------	----------	----------	1, 728
Summit	640, 478	58, 283	25, 473, 640	942, 525	11, 390, 574	432, 842	1, 946, 614
Tooele	71, 908	6, 544	18, 054, 684	668, 023	1, 211, 553	46, 039	893, 917
Uintah	1, 276	116	----------	----------	----------	----------	462
Utah	895, 746	81, 513	32, 347, 496	1, 196, 858	115, 860	4, 403	3, 441, 416
Wasatch	178, 067	16, 204	9, 262, 976	342, 730	7, 480, 755	284, 269	850, 458
Washington	727, 600	66, 212	----------	----------	----------	----------	66, 240
	151, 236, 505	13, 762, 522	158, 423, 453	5, 861, 668	74, 581, 072	2, 834, 081	28, 970, 974
Total, 1930	180, 526, 423	23, 468, 435	230, 989, 780	11, 549, 489	88, 990, 938	4, 271, 565	48, 653, 464

Ore, old tailings, etc., sold or treated and lode mines producing in Utah, 1930 and 1931, by counties

County	Ore, old tailings, etc. (short tons)		Lode mines producing		County	Ore, old tailings, etc. (short tons)		Lode mines producing	
	1930	1931	1930	1931		1930	1931	1930	1931
Beaver	26, 699	7, 128	3	4	Sevier	112	100	1	1
Box Elder	132	12	5	1	Summit	276, 556	119, 642	5	5
Cache	----------	2	------	1	Tooele	45, 726	49, 597	15	20
Garfield	----------	2	------	1	Uintah	----------	4	------	1
Iron	120	115	1	1	Utah	214, 217	153, 286	13	7
Juab	159, 847	69, 739	21	16	Wasatch	179, 831	66, 879	5	5
Millard	32	----------	3	------	Washington	750	1, 138	1	1
Piute	13	441	2	5					
Salt Lake	10, 137, 056	8, 486, 532	27	27		11, 041, 841	8, 954, 617	103	96
San Juan	750	----------	1	------					

MINING INDUSTRY

Activity of the mining industry in Utah in 1931 represented continuation of the downward trend of 1930. Lower sale prices for silver, copper, lead, and zinc resulted in further curtailment at nearly all the large producing mines; the Park Utah mine, one of the largest producers of gold, silver, lead, and zinc in Utah, closed March 1. As a result of the pronounced curtailment the output of each of the five metals decreased decidedly; the output of silver was less than in any year since records were started in 1903, and the output of both copper and lead was less than in any year since 1922. The output of copper ore, representing nearly 92 percent of the State output of ore, old tailings, etc., decreased more than 15 percent from 1930 as a result of continued decline in output from the Utah Copper property at Bingham. Substantial increases were made in output of lead-zinc ore from the United States and Niagara mines at Bingham, but these gains were more than offset by notable decreases from mines in the Park City region. There was a general decrease in output of lead ore from nearly all lead-producing mines in Utah in 1931, particularly those in the Tintic and Bingham districts. The only class of ore in which there was a decided increase in Utah in 1931 was siliceous gold ore; this apparent gain was due chiefly to the fact that ore from the Mammoth mine contained twice as much gold in 1931 as in 1930 and was consequently classed as gold ore instead of gold and silver ore, but also to increased output from the Eureka Standard mine, both in the Tintic district.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Utah in 1931, with content in terms of recovered metals

Source	Mines producing	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	28	[1] 94, 769	72, 056. 66	683, 132	628, 855	1, 690, 484	----------
Dry gold and silver ore	7	[2] 18, 313	2, 705. 94	124, 479	230, 150	417, 281	----------
Dry silver ore	10	[3] 20, 835	1, 224. 10	500, 295	249, 221	1, 273, 250	----------
Copper ore	21	[4] 8, 212, 141	65, 018. 65	679, 503	[5] 147, 213, 271	589, 854	----------
Lead ore	49	[6] 140, 960	9, 543. 71	2, 432, 017	650, 067	56, 675, 177	----------
Copper-lead ore	2	79	3. 37	662	7, 841	8, 050	----------
Lead-zinc ore	28	467, 520	48, 149. 77	3, 870, 872	2, 257, 100	97, 769, 357	74, 581, 072
Total, lode mines	[7] 96	8, 954, 617	198, 702. 20	8, 290, 960	[5] 151, 236, 505	158, 423, 453	74, 581, 072
Total, placers	9	----------	37. 92	6	----------	----------	----------
	105	8, 954, 617	198, 740. 12	8, 290, 966	[5] 151, 236, 505	158, 423, 453	74, 581, 072
Total, 1930	103	11, 041, 841	208, 455. 03	13, 129, 421	[8] 180, 526, 423	230, 989, 780	88, 990, 938

[1] Includes 3,000 tons of old tailings treated by cyanidation, 100 tons of old tailings concentrated, and 1 ton of old tailings sold to a smelter.

[2] Includes 9,063 tons of old tailings sold to a smelter.

[3] Includes 174 tons of old tailings sold to a smelter.

[4] Includes 2 tons of old matte and 19 tons of old mill cleanings sold to a smelter.

[5] Includes 5,386,279 pounds of copper saved from precipitates.

[6] Includes 47 tons of old tailings sold to a smelter.

[7] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

[8] Includes 3,189,620 pounds of copper saved from precipitates.

Value of metals from ore, old tailings, etc., sold or treated in Utah in 1931, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total
Dry gold ore	94, 769	$1, 489, 543	$198, 108	$57, 226	$62, 548	----------	$1, 807, 425
Dry gold and silver ore	18, 313	55, 937	36, 099	20, 944	15, 439	----------	128. 419
Dry silver ore	20, 835	25, 304	145, 085	22, 679	47, 110	----------	240, 178
Copper ore	8, 212, 141	1, 344, 055	197, 056	[1] 13, 396, 408	21, 825	----------	14, 959, 344
Lead ore	140, 960	197, 286	705, 285	59, 156	2, 096, 982	----------	3, 058, 709
Copper-lead ore	79	70	192	713	298	----------	1, 273
Lead-zinc ore	467, 520	995, 344	1, 122, 553	205, 396	3, 617, 466	$2, 834, 081	8, 774, 840
	8, 954, 617	4, 107, 539	2, 404, 378	[1] 13, 762, 522	5, 861, 668	2, 834, 081	28, 970, 188
Total, 1930	11, 041, 841	4, 309, 148	5, 054, 827	[2] 23, 468, 435	11, 549, 489	4, 271, 565	48, 653, 464

[1] Includes value of 5,386,279 pounds of copper saved from precipitates.

[2] Includes value of 3,189,620 pounds of copper saved from precipitates.

GOLD ORE

Twenty-five mines and three dumps produced 91,668 tons of siliceous gold ore and 3,101 tons of old tailings in 1931 compared with 16 mines producing 65,200 tons of siliceous gold ore in 1930. This apparent increase was due chiefly to the fact that ore from the Mammoth mine contained twice as much gold in 1931 as in 1930 and was consequently classed as gold ore instead of gold and silver ore. There was, however, a good increase in gold ore from the Eureka Standard mine. The metals recovered from gold ore and old tailings were valued at $1,807,425, an average of $19.07 to the ton. The material yielded on the average $15.72 in gold and 7.21 ounces of silver to the ton, 0.33 percent copper, and 0.89 percent lead. Nearly 82 percent of the gold ore and old tailings was crude ore of smelting grade from the Eureka Standard, Mammoth, and North Lily properties, all in the Tintic district.

GOLD AND SILVER ORE

Four mines and 3 dumps produced 9,250 tons of siliceous gold and silver ore and 9,063 tons of old tailings in 1931 compared with 11 mines and 3 dumps producing 47,633 tons of gold and silver ore and 51,825 tons of old tailings in 1930. There was a general decrease of about 35,000 tons in output of gold and silver ore and about 43,000 tons in old tailings from properties in the Tintic district, Juab County. The total gold and silver ore and old tailings yielded on the average $3.05 in gold and 6.80 ounces of silver to the ton, 0.63 percent copper, and 1.14 percent lead; the recovered metals were valued at $128,419, an average of $7.01 to the ton. About 46 percent of the gold and silver material was old tailings shipped from the Eureka Hill dump in the Tintic district; most of the remainder was crude ore of smelting grade from the Grand Central mine of the Chief Consolidated Mining Co., also in the Tintic District.

SILVER ORE

Dry and siliceous silver ore and old tailings were produced from 9 mines and 1 dump in 1931 compared with 15 mines and 1 dump in 1930. The output decreased from 57,436 tons of ore and 916 tons of old tailings and matte in 1930 to 20,661 tons of ore and 174 tons of old tailings in 1931, chiefly as the result of curtailment in shipments of siliceous silver ore from the Tintic Standard mine. The ore and old tailings yielded on the average $1.21 in gold and 24.01 ounces of silver to the ton, 0.60 percent copper, and 3.06 percent lead; the recovered metals were valued at $240,178, an average of $11.53 to the ton. Nearly 91 percent of the silver ore and old tailings was produced from the Tintic Standard and Plutus mines in the Tintic district.

COPPER ORE

The output of copper ore, etc., decreased more than 15 percent—from 9,696,962 tons in 1930 to 8,212,141 tons in 1931. This large decline was due to general curtailment in world output of copper, which resulted in a notable decrease in the mining of copper ore at the Utah Copper Co. property at Bingham. The total copper ore, etc., representing nearly 92 percent of the State output of ore, old tailings, etc., yielded on the average 16 cents in gold, 0.08 ounce of silver, 17 pounds (0.86 percent) of copper, and a little lead to the ton; the recovered metals were valued at $14,469,193, an average of $1.76 to the ton and about half the total value of the metal output of the State. Salt Lake County produced nearly all the copper ore, chiefly from the Utah Copper property at Bingham.

LEAD ORE

The metals recovered from lead ore and old tailings produced from 48 mines and 1 dump in 1931 were valued at $3,058,709 (an average of $21.70 to the ton) compared with 58 producers and $6,172,751 in 1930. The lead ore and old tailings, representing 1.57 percent of the total State output, decreased from 237,240 tons in 1930 to 140,960 tons in 1931. There was, in fact, a general decrease in output of lead ore from nearly all lead-producing mines in Utah in 1931, particularly those in the Tintic and Bingham districts. The unusually large decreases from the North Lily and Eureka Lilly properties in the Tintic district accounted for nearly half the total decline. In 1931 the lead material yielded on the average $1.40 in gold and 17.25 ounces of silver to the ton, 0.23 percent copper, and 20.10 percent lead. The Tintic Standard mine in the Tintic district, Utah County, produced nearly half the State output of lead ore, followed by the Bluestone Lime & Quartzite Mining Co. at Bauer in the Rush Valley district, Tooele County, and the Utah-Apex mine at Bingham, Salt Lake County.

COPPER-LEAD ORE

Two properties produced 79 tons of copper-lead ore in 1931 compared with seven producing 52,757 tons in 1930; the metals recovered from the ore in 1931 were valued at $1,273, an average of $16.11 to the ton. The Utah-Apex mine at Bingham produced nearly all the copper-lead ore in 1930, but the company made no shipments of such material in 1931. Nearly all the output in 1931 came from the Bingham Bemis property at Bingham.

LEAD-ZINC ORE

All the zinc recovered from Utah mines in 1931 came from lead-zinc ore. The output of this ore, representing 5 percent of the State output of ore, old tailings, etc., decreased from 831,872 to 467,520 tons and yielded on the average $2.13 in gold and 8.28 ounces of silver to the ton, 0.24 percent copper, 10.46 percent lead, and 7.98 percent zinc; the recovered metals were valued at $8,774,840, an amount second only to the value of the metals recovered from copper ore, etc. More than 56 percent of the lead-zinc ore came from the Bingham district; nearly 40 percent came from the Park City region, where the output decreased decidedly—from 453,150 tons in 1930 to 185,870 tons in 1931. The output of lead-zinc ore from the properties of the Park Utah Consolidated Mines Co. decreased more than 108,000 tons, and there was also a large decrease in output from the Silver King Coalition mine. As no old tailings were treated in 1931, 100,000 tons of the decrease in the Park City region were old tailings. The output of lead-zinc ore from the Bingham district decreased from 338,806 to 262,862 tons. Unusually large decreases in output from the Lark group of the United States Smelting, Refining & Mining Co. and the Utah-Apex mine more than offset large increases from the Niagara and United States mines. There was also a decided decrease in output of lead-zinc ore from the Horn Silver (Tintic Lead Co.) mine at Frisco, Beaver County. The United States mine of the United States Smelting, Refining & Mining Co. at Bingham produced more than 42 percent and the Silver King Coalition mine at Park City 24 percent of the State output of lead-zinc ore in 1931; other large producers were the Park Utah Consolidated, Niagara, Park City Consolidated, and Honerine (Combined Metals Reduction Co.) properties.

Ore, old tailings, etc., sold or treated in Utah in 1931, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	2,486	687.77	14,526	381	56,165	
Box Elder	12	13.01	16			
Iron	[1] 115	20.85	85			
Juab	[2] 26,500	6,936.45	115,475	282,861	117,236	
Piute	215	274.75	722	85	92	
Salt Lake	1,361	805.73	9,719	27,142	46,827	
Sevier	100	80.01	254			
Tooele	[3] 3,644	1,262.91	288	1,338		
Utah	60,335	61,973.83	542,047	317,048	1,470,164	
Washington	1	1.35				
	94,769	72,056.66	683,132	628,855	1,690,484	
Total, 1930	65,200	56,292.01	433,039	275,736	1,343,692	

DRY GOLD AND SILVER ORE

Juab	[4] 18,017	2,644.94	121,872	229,368	411,781	
Piute	[5] 173	24.00	1,034	721	4,400	
Salt Lake	123	37.00	1,573	61	1,100	
	18,313	2,705.94	124,479	230,150	417,281	
Total, 1930	99,458	9,953.31	626,289	1,336,396	2,078,517	

DRY SILVER ORE

Juab	[6] 10,323	714.01	268,214	150,398	569,000	
Salt Lake	460	28.72	14,102	2,379	16,500	
Tooele	6		404			
Utah	9,983	480.21	215,306	96,167	687,400	
Wasatch	63	1.16	2,269	277	350	
	20,835	1,224.10	500,295	249,221	1,273,250	
Total, 1930	58,352	3,007.83	1,156,592	453,886	2,405,434	

[1] Includes 100 tons of old tailings concentrated.
[2] Includes 1 ton of old tailings sold to a smelter.
[3] Includes 3,000 tons of old tailings treated by cyanidation
[4] Includes 8,890 tons of old tailings sold to a smelter.
[5] Old tailings sold to a smelter.
[6] Includes 174 tons of old tailings sold to a smelter.

Ore, old tailings, etc., sold or treated in Utah in 1931, by counties, with content in terms of recovered metals—Continued

COPPER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	510	8.95	3,801	63,979	28,728	----------
Garfield	2	----------	7	281	----------	----------
Juab	2,038	456.80	25,094	171,275	28,600	----------
Salt Lake	[7] 8,202,622	61,326.80	633,696	[8] 145,983,165	529,240	----------
Tooele	234	19.09	793	19,349	286	----------
Uintah	4	----------	5	1,276	----------	----------
Utah	5,594	3,207.01	16,107	246,346	3,000	----------
Washington	1,137	----------	----------	727,600	----------	----------
	8,212,141	65,018.65	679,503	[8] 147,213,271	589,854	----------
Total, 1930	9,696,962	80,953.27	944,113	[9] 171,577,491	506,200	----------

LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Beaver	858	37.79	16,751	4,739	422,700	----------
Cache	2	----------	3	----------	1,900	----------
Juab	[10] 9,718	728.17	242,427	88,398	3,043,802	----------
Piute	40	4.05	545	857	6,953	----------
Salt Lake	18,969	2,044.31	202,145	272,964	6,334,231	----------
Summit	123	6.00	2,381	691	49,658	----------
Tooele	33,980	3,245.36	216,372	42,652	16,519,585	----------
Utah	76,805	3,452.03	1,738,587	236,185	30,096,848	----------
Wasatch	465	26.00	12,806	3,581	199,500	----------
	140,960	9,543.71	2,432,017	650,067	56,675,177	----------
Total, 1930	237,240	19,660.23	3,362,487	1,133,129	86,489,490	----------

LEAD-ZINC ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Beaver	3,274	33.35	32,464	4,843	527,575	477,719
Juab	3,143	65.29	28,093	6,425	634,847	675,270
Piute	13	1.00	150	34	2,200	835
Salt Lake	262,918	42,773.31	1,660,551	1,423,233	60,492,730	53,228.506
Summit	119,519	2,299.02	1,602,155	639,787	25,423,982	11,390,574
Tooele	11,733	224.71	41,029	8,569	1,534,813	1,211,553
Utah	569	44.21	1,864	----------	90,084	115,860
Wasatch	66,351	2,708.88	504,566	174,209	9,063,126	7,480,755
	467,520	48,149.77	3,870,872	2,257,100	97,769,357	74,581,072
Total, 1930	831,872	36,071.54	6,479,433	3,545,699	135,837,073	88,990,938

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[7] Includes 2 tons of old matte and 19 tons of old mill cleanings sold to a smelter.
[8] Includes 5,386,279 pounds of copper saved from precipitates.
[9] Includes 3,189,620 pounds of copper saved from precipitates.
[10] Includes 47 tons of old tailings sold to a smelter.

Zinc products (as marketed from Utah mines and mills) sold to smelters and electrolytic plants in 1931

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of ore or concentrates	Recovered zinc
		Short tons	*Pounds*	*Percent*	*Pounds*
Zinc concentrates	Beaver, Juab, Piute, Salt Lake, Summit, Tooele, Utah, and Wasatch.	76,329	83,638,358	54.79	74,314,962
Lead-zinc concentrates	Salt Lake	264	294,345	55.75	266,110
		76,593	83,932,703	54.79	74,581,072
Total, 1930	----------	88,943	98,160,527	55.18	88,990,938

METALLURGIC INDUSTRY

In 1931, 96.71 percent of the ore, old tailings, etc., from Utah mines was concentrated; the resulting concentrates, with the first-class shipping ore, precipitates, other old tailings, etc., were smelted and yielded metals valued at $28,970,188, a decrease of $19,683,276 from 1930. The large custom copper-smelting plants at Garfield and International and the lead plants at Murray and International were operated at greatly reduced rate; the lead plant at Midvale was the only plant to operate at normal rate. These smelters are discussed under Salt Lake and Tooele Counties.

There were no important changes in metallurgical processes used in Utah during 1931. Due to curtailment in ore output nearly all the large mills operated at less than half capacity. The Arthur mill of the Utah Copper Co. was idle, as in 1930, and the Magna plant was operated at about three fourths maximum capacity. These two plants are the largest concentrators in Utah or any neighboring State, having a combined maximum capacity of 60,000 tons a day. Most of Utah's metal output in recent years has originated in first-class ore and concentrates smelted, but in 1931 a little gold from old tailings was recovered by cyanidation.

In Utah 10 milling plants were running in 1931; 1 treated old tailings in a cyanidation plant, 1 used jigs and tables with flotation cells, 1 used jigs only, and 7 used straight flotation. At two properties copper was precipitated from mine water or from ore leached in place; most of this copper was recovered at the mine-water precipitation plant of the Utah Copper Co. near Copperton. The Ohio Copper Co. continued to leach ore in place at its plant at Lark, but production of copper decreased decidedly from 1930.

The report on ore-concentration statistics for 1931, giving flotation reagents used and kinds of ore treated by flotation, with results, has been issued by the Bureau of Mines as a chapter of Mineral Resources.

Concentrates produced in Utah in 1931 yielded 52 percent of the total gold, 63 percent of the silver, 93 percent of the copper, 70 percent of the lead, and all the zinc. The quantity of copper concentrates, which exceeded all others, decreased 16 percent, but the average grade of the concentrates increased from 31.97 percent in 1930 to 32.61 percent in 1931. The largest decrease (37 percent) was in quantity of lead concentrates; large decreases were also recorded in production of dry and siliceous concentrates and zinc concentrates.

The nine concentrating plants running in Utah in 1931 treated 8,660,183 tons of mill ore and 100 tons of old tailings from Utah mines, a decrease from 1930 of 1,875,862 tons, mostly in copper ore; 99.5 percent of the total was treated by flotation. The following table summarizes all ore and old tailings concentrated, separates the ore, etc., by classes, and separates the concentrates produced by classes and by the three methods of concentration.

Utah ore and old tailings concentrated in 1931, by classes of ore, etc., methods of concentration, and classes of concentrates

Class of material concentrated	Method of concentration	Ore and old tailings concentrated	Gross content of mill feed				
			Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Siliceous gold old tailings	Flotation	100	17.00	17			
Copper sulphide ore	do	8, 147, 764	74, 144. 65	669, 746	156, 600, 024		
Lead oxidized ore	do	43, 594	2, 405. 18	991, 814	171, 794	15, 195, 714	
Lead-zinc sulphide ore	do	426, 746	60, 177. 39	3, 975, 468	3, 290, 445	100, 501, 958	96, 866, 553
		8, 618, 204	136, 744. 22	5, 637, 045	160, 062, 263	115, 697, 672	96, 866, 553
Do	Gravity and flotation	40, 774	815. 00	180, 221	160, 000	7, 339, 320	8, 538, 076
Lead sulphide ore	Gravity	1, 305	31. 31	3, 025	1, 670	161, 228	
Total		8, 660, 283	137, 590. 53	5, 820, 291	160, 223, 933	123, 198, 220	105, 404, 629

Class of material concentrated	Method of concentration	Concentrates produced		Gross content of concentrates				
		Class	Quantity	Gold	Silver	Copper	Lead	Zinc
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Siliceous gold old tailings	Flotation	Siliceous gold	2	12. 54	13			
Copper sulphide ore	do	Copper sulphide	218, 854	54, 124. 00	534, 724	142, 756, 877		
Lead oxidized ore	do	Lead oxidized	15, 516	1, 671. 93	819, 993	131, 855	13, 955, 894	
Lead-zinc sulphide ore	do	Lead sulphide	78, 030	35, 490. 01	3, 414, 753	1, 809, 188	91, 411, 429	
		Iron sulphide	49, 555	8, 200. 88	66, 113	202, 567	1, 674, 244	
		Zinc sulphide [1]	[1] 71, 716	3, 933. 40	230, 926	806, 485	2, 990, 189	78, 299, 673
			199, 301	47, 624. 29	3, 711, 792	2, 818, 240	96, 075, 862	78, 299, 673
			433, 673	103, 432. 76	5, 066, 522	145, 706, 972	110, 031, 756	78, 299, 673
Do	Gravity and flotation	Lead sulphide	8, 568	457. 57	153, 444	67, 252	6, 652, 394	
		Iron sulphide	2, 000	38. 91	2, 038	3, 646	20, 409	
		Zinc sulphide	4, 877	29. 00	3, 598	15, 633	43, 054	5, 633, 030
			15, 445	525. 48	159, 080	86, 531	6, 715, 857	5, 633, 030
Lead sulphide ore	Gravity	Lead sulphide	262	25. 05	2, 418	1, 335	128, 982	
Total			449, 380	103, 983. 29	5, 228, 020	145, 794, 838	116, 876, 595	83, 932, 703

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[1] Includes 264 tons of lead-zinc concentrates.

Gross metal content of Utah concentrates produced in 1931, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	51, 557	8, 252. 33	68, 164	206, 213	1, 694, 653	
Copper	218, 854	54, 124. 00	534, 724	142, 756, 877		
Lead	102, 376	37, 644. 56	4, 390, 608	2, 009, 630	112, 148, 699	
Zinc	76, 329	3, 869. 81	231, 565	797, 267	2, 956, 004	83, 638, 358
Lead-zinc	264	92. 59	2, 959	24, 851	77, 239	294, 345
	449, 380	103, 983. 29	5, 228, 020	145, 794, 838	116, 876, 595	83, 932, 703
Total, 1930	582, 390	110, 650. 24	8, 193, 168	172, 302, 135	168, 736, 747	97, 897, 581

Mine production of metals from Utah concentrates in 1931, in terms of recovered metals

BY COUNTIES

	Ore and old tailings to concentrating mills		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	3, 274		937	33. 35	32, 464	4, 843	527, 575	477, 719
Iron		100	2	12. 54	13			
Juab	3, 259		1, 771	68. 16	30, 201	6, 667	658, 665	675, 270
Piute	13		4	1. 00	150	34	2, 200	835
Salt Lake	8, 410, 842		374, 888	96, 902. 31	2, 196, 009	139, 574, 501	60, 502, 230	53, 228, 506
Summit	119, 519		30, 777	2, 299. 02	1, 602, 155	639, 787	25, 423, 982	11, 390, 574
Tooele	12, 878		2, 751	244. 76	42, 713	9, 317	1, 649, 036	1, 211, 553
Utah	44, 047		15, 797	1, 713. 27	819, 749	111, 819	13, 463, 925	115, 860
Wasatch	66, 351		22, 453	2, 708. 88	504, 566	174, 209	9, 063, 126	7, 480, 755
	8, 660, 183	100	449, 380	103, 983. 29	5, 228, 020	140, 521, 177	111, 290, 739	74, 581, 072
Total, 1930	10, 435, 485	100, 660	582, 390	110, 650. 24	8, 193, 168	166, 518, 209	162, 256, 714	88, 761, 604
BY CLASSES OF CONCENTRATES								
Dry and siliceous			51, 557	8, 252. 33	68, 164	137, 741	1, 614, 327	
Copper			218, 854	54, 124. 00	534, 724	138, 150, 904		
Lead			102, 376	37, 644. 56	4, 390, 608	1, 495, 021	106, 948, 516	
Zinc			76, 329	3, 869. 81	231, 565	714, 526	2, 657, 223	74, 314, 962
Lead-zinc			264	92. 59	2, 959	22, 985	70, 673	266, 110

Ore of all kinds shipped to smelters amounted to 3 percent of the total output of ore, etc., and yielded 47 percent of the gold, 36 percent of the silver, 3.5 percent of the copper, and 29.6 percent of the lead. Unusually large decreases were recorded in shipments of all classes of first-class smelting ore except siliceous gold ore, which increased nearly 41 percent over 1930.

Gross metal content of Utah crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Ore (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	121, 577	75, 211. 98	1, 260, 844	1, 104, 205	4, 836, 069	----------
Copper	64, 356	10, 720. 65	144, 658	3, 774, 006	989, 115	----------
Lead	96, 014	7, 845. 55	1, 609, 238	656, 039	44, 959, 301	----------
Copper-lead	79	3. 37	662	8, 196	11, 611	----------
	282, 026	93, 781. 55	3, 015, 402	5, 542, 446	50, 796, 096	----------
Total, 1930	451, 517	94, 248. 73	4, 671, 750	10, 869, 536	73, 796, 002	262, 946

Mine production of metals from Utah crude ore shipped to smelters in 1931, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	3, 854	734. 51	35, 078	69, 099	507, 593	----------
Box Elder	12	13. 01	16	----------	----------	----------
Cache	2	----------	3	----------	1, 900	----------
Garfield	2	----------	7	281	----------	----------
Iron	15	8. 31	72	----------	----------	----------
Juab	57, 368	10, 902. 97	724, 591	875, 919	3, 879, 389	----------
Piute	254	261. 92	1, 267	942	7, 045	----------
Salt Lake	75, 669	9, 942. 93	326, 318	2, 747, 883	6, 926, 448	----------
Sevier	100	80. 01	254	----------	----------	----------
Summit	123	6. 00	2, 381	691	49, 658	----------
Tooele	33, 719	4, 360. 71	216, 173	62, 591	16, 405, 648	----------
Uintah	4	----------	5	1, 276	----------	----------
Utah	109, 239	67, 444. 02	1, 694, 162	783, 927	18, 883, 571	----------
Wasatch	528	27. 16	15, 075	3, 858	199, 850	----------
Washington	1, 137	----------	----------	727, 600	----------	----------
	282, 026	93, 781. 55	3, 015, 402	5, 274, 067	46, 861, 102	----------
Total, 1930	451, 517	94, 248. 73	4, 671, 750	10, 327, 518	67, 324, 666	229, 334

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	121, 577	75, 211. 98	1, 260, 844	1, 061, 366	3, 113, 615	----------
Copper	64, 356	10, 720. 65	144, 658	3, 667, 966	589, 854	----------
Lead	96, 014	7, 845. 55	1, 609, 238	536, 894	43, 149, 583	----------
Copper-lead	79	3. 37	662	7, 841	8, 050	----------

The miscellaneous material consisted of 9,306 tons of old tailings, mill cleanings, and matte shipped for smelting and copper precipitates from mine waters and from leaching of ore in place. This miscellaneous material yielded 772.53 ounces of gold, 47,538 ounces of silver, 5,441,261 pounds of copper, and 271,612 pounds of lead, valued in all at $534,961. Most of the gold, silver, and lead came from old tailings from the Tintic district, Juab County, whereas most of the copper was recovered from precipitates from ore leached in place and from mine waters from the Bingham or West Mountain district, Salt Lake County.

REVIEW BY COUNTIES AND DISTRICTS

Notes usually given under the district reviews in this series of reports have been greatly curtailed in an effort to reduce the size of the chapters for 1931. Details on development, notes from printed reports, and statements comparing the production of the current year with that of past years have been omitted unless of unusual importance.

BEAVER COUNTY

In 1931 four lode mines in Beaver County produced 7,128 tons of ore yielding metals valued at $98,643, compared with $489,155 from three lode mines in 1930. The marked decrease, especially in silver, lead, and zinc, was due to curtailed output of lead-zinc ore from the Horn Silver mine of the Tintic Lead Co. at Frisco.

Fortuna (Unorganized) district.—The Utah Gold Co. shipped a test lot of gold ore from the Gold Queen-Lucky Boy-Gondola group north of Beaver and developed gold ore of milling grade.

San Francisco district.—Two mines in the San Francisco district produced 6,864 tons of ore yielding $15,764 in gold, 64,929 ounces of silver, 73,020 pounds of copper, 872,148 pounds of lead, and 477,719 pounds of zinc, valued in all at $91,660, or $13.35 in metals a ton, compared with a district output of $469,128 in 1930. The Horn Silver mine of the Tintic Lead Co. at Frisco was the chief producer, but its output of ore decreased from 25,085 tons in 1930 to 6,810 tons in 1931. The mine was closed September 1, except for development. Nearly half (3,220 tons) of the output in 1931 was lead-zinc ore shipped to the flotation mill at Bauer and separated into lead concentrates and zinc concentrates; the remainder was ore of smelting grade, consisting of 2,485 tons of siliceous gold ore, 510 tons of sulphide copper ore, 504 tons of carbonate lead ore, and 91 tons of sulphide lead ore. The Frisco Silver-Lead Mining Co. shipped two cars of lead-zinc ore to the custom flotation plant at Midvale.

Star and North Star district.—The Moscow Silver Mines Co. operated its mine southwest of Milford and shipped 263 tons of first-class silver-lead ore to the smelter at Midvale.

BOX ELDER COUNTY

The production of Box Elder County in 1931 consisted of gold and silver recovered from small lots of gold ore shipped by lessees from the property of the Century Consolidated Gold Mining Co. in the Park Valley district and oxidized iron ore from the Tecoma mine in the Lucin district shipped to a California paint company.

CACHE COUNTY

A test lot of oxidized lead ore from the Laura property in the La Plata district was shipped to Murray for smelting.

GARFIELD COUNTY

The output of Garfield County in southeastern Utah west of the Colorado River consisted of placer gold from the North Wash claim in the Imperial district and a test lot of oxidized copper ore shipped from a prospect in the Cannonville district near Tropic.

GRAND COUNTY

A little placer gold was recovered from the banks of the Colorado River near Moab, and late in the year unusual interest was shown in placer work in the vicinity.

IRON COUNTY

Iron County in southwestern Utah has contributed little to the nonferrous metal output of the State. In 1931 the county continued to supply iron ore from Desert Mound for making pig iron at the smelting and coking plants at Ironton near Springville.

Stateline district (*Gold Springs*).—The Gold Coin property near Modena was operated in February by lessees. One lot of first-class gold ore was shipped for smelting, as well as a small lot of gold concentrates resulting from the treatment of old tailings in a 25-ton flotation plant.

JUAB COUNTY

Thirteen lode mines and three old tailings dumps in Juab County produced metals valued at $758,980 in 1931, an amount smaller than any annual valuation since 1883 and a decided decrease from $1,646,258 in 1930. Most of the ore came from the Mammoth, Chief Consolidated, and Plutus properties; nearly all the old tailings came from the Eureka Hill dump.

Detroit district.—Two cars of oxidized copper ore containing about 0.6 ounce of gold to the ton were shipped from the Ibex property 18 miles northwest of Sugarville; late in the year the mine was leased by the Utah Central Mines Co.

Fish Springs district.—One car of oxidized lead ore containing 140 ounces of silver to the ton was shipped from the Galena property near Callao by a lessee.

Mount Nebo district.—The Mount Nebo mine in the Wasatch Range east of Mona produced a test lot of carbonate lead ore.

Spring Creek district.—A small lot of old tailings containing gold and silver was shipped from the Queen of Sheba dump near Ibapah to a smelter near Salt Lake City.

Tintic district.—Production from the old mines near Eureka in the western part of the Tintic district in Juab County and from the mines in the eastern section of the Tintic district in Utah County was much less than in 1930. The mines in both sections of the Tintic district are reviewed here, and their output is included in the following table.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Utah, 1930 and 1931, and total, 1869–1931, in terms of recovered metals

	Mines producing	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc	Total value
1931		*Short tons*		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Juab County	10	[1] 69,083	$230,728	790,673	920,008	4,575,603	675,270	$738,701
Utah County	5	147,615	1,363,293	2,496,075	648,739	32,277,996	115,860	3,344,879
	15	[1] 216,698	1,594,021	3,286,748	1,568,747	36,853,599	791,130	4,083,580
Total, 1930	26	[2] 373,468	1,649,141	4,834,829	2,861,700	58,948,000	952,439	6,875,688
Total, 1869–1931	-------	(3)	43,573,594	225,483,842	217,980,224	1,639,478,338	31,778,942	336,090,561

[1] Includes 9,111 tons of old tailings sold to a smelter.
[2] Includes 52,740 tons of old tailings and 867 tons of old slag sold to a smelter.
[3] Figures not available.

NOTE.—Total dividends, 1869–1931, $54,610,562.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Utah, in 1931, by classes of ore, in terms of recovered metals

Class of ore	Mines producing	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	13	[1] 125,154	72,745.09	1,262,905	1,075,830	3,255,581	----------
Copper	1	1,985	424.00	25,072	168,399	28,600	----------
Lead	9	[2] 85,847	3,832.15	1,968,814	318,093	32,844,487	----------
Lead-zinc	3	3,712	109.50	29,957	6,425	724,931	791,130
	[3] 15	216,698	77,110.74	3,286,748	1,568,747	36,853,599	791,130

[1] Includes 9,064 tons of old tailings sold to a smelter.
[2] Includes 47 tons of old tailings sold to a smelter.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

The output of silver, copper, and lead from the Chief Consolidated properties—Chief No. 1, Grand Central, and Eureka Hill mines—was decidedly less in 1931 than in 1930; the output of gold and zinc increased slightly. Total shipments of ore from these mines, including 2,838 tons of mill ore, were reported as 12,098 tons in 1931 compared with 26,052 tons in 1930. The output of the Chief or No. 1 mine was 5,957 tons of ore containing 310 ounces of gold, 81,690 ounces of silver, 3,356 pounds of copper, 1,194,629 pounds of lead, and 851,217 pounds of zinc. The company received $36,231 from the sale of ore, and after various charges were deducted the net loss was $112,566. Most (2,838 tons) of the output was lead-zinc ore shipped to the custom flotation mill at Midvale and separated into lead concentrates, zinc concentrates, and iron concentrates; the remainder was ore of smelting grade and consisted of 1,749 tons of dry and siliceous silver ore and 1,370 tons of silver-lead ore. The Grand Central mine produced 6,071 tons of ore, 1,576 ounces of gold, 65,894 ounces of silver, 121,012 pounds of copper, and 42,729 pounds of lead. The ore sold for $33,497, and after various charges were deducted the net loss was $7,937. Nearly all (5,988 tons) of the output was dry and siliceous gold and silver ore of smelting grade.

The Plutus mine, controlled and operated by the Chief Consolidated Mining Co., produced 12,467 tons of siliceous silver ore and oxidized silver-lead ore containing 683 ounces of gold, 340,100 ounces of silver, 159,802 pounds of copper, and 941,535 pounds of lead. The output of each of the four metals, particularly lead and silver, was much less than in 1930. Of the 12,467 tons of ore 10,207 tons of dry and siliceous silver ore and 2,144 tons of silver-lead ore were shipped for smelting, and 47 tons of silver-lead ore and 69 tons of dry and siliceous ore went to the concentrator at the Chief mine. The Chief Consolidated Mining Co. received $87,863 from the sale of ore from the Plutus mine, and after various expenses were deducted the net loss was $10,776.

The Chief Consolidated Mining Co. received $209,405 from the sale of ore, concentrates, lime, etc., from its various properties; after costs were deducted net operating loss was $112,798. Net surplus on December 31, 1931, was $3,550,181.

The Chief Consolidated flotation plant at Eureka operated a short time in 1931 and treated 252 tons of ore from the Plutus and Eureka Lilly mines.

The United States Smelting, Refining & Mining Co. worked the Eagle & Blue Bell mine the last four months of the year and shipped 1,279 tons of first-class siliceous gold ore to the smelter at Garfield.

The Victoria property adjoining the Eagle & Blue Bell mine was worked by the United States Smelting, Refining & Mining Co. the latter half of the year. About 2,200 tons of first-class ore were shipped to various smelters near Salt Lake City; most of the output was oxidized copper ore. The ore output in 1931 was only about 18 percent of that in 1930, and there was a corresponding decrease in recovered metals.

The Mammoth Mining Co. continued to operate its property near Mammoth south of Eureka and shipped 28,032 tons of siliceous gold ore and oxidized silver-lead ore of smelting grade, an increase of 634 tons over 1930. Most of the output was siliceous gold ore, and the production of gold was nearly double that in 1930; the production of lead was more than that reported for 1930, but the production of silver and copper was less. The report to the industrial commission gave 28,032 tons of ore containing 6,438.52 ounces of gold, 181,143 ounces of silver, 215,437 pounds of copper, and 655,927 pounds of lead.

No old tailings were shipped from the Mammoth dump in 1931; but several thousand tons of material containing chiefly gold and silver were shipped from the Eureka Hill dump and a few hundred tons of similar material from the Chief dump, both owned by the Chief Consolidated Mining Co.

The Centennial Eureka property, owned by the United States Smelting, Refining & Mining Co., was operated in 1931, and 2,837 tons of siliceous gold and silver ore were shipped for smelting.

Lessees shipped several cars of first-class gold and silver ore from the Gold Chain property early in 1931, and the mine was later sold to the Mammoth Mining Co.

Other properties in the Juab County part of the Tintic district, from which ore was shipped by lessees, were the Iron Blossom and Dragon mines.

The chief producers in the eastern part of the Tintic district in Utah County were the Tintic Standard, Eureka Standard, North Lily, and Eureka Lilly properties.

The North Lily mine was worked throughout the year, but the output of ore decreased from 55,717 tons in 1930 to 23,700 tons in 1931; production of gold decreased 10,283.64 ounces, silver 292,392 ounces, and lead 11,485,532 pounds. Of the 23,700 tons of ore shipped from the mine in 1931, 16,255 tons were first-class siliceous gold ore, less than one third (7,245 tons) was oxidized silver-lead ore, and the remainder (200 tons) was sulphide lead-zinc ore. According to the printed annual report of the North Lily Mining Co. for the year ended December 31, 1931, the mine produced 23,700 dry tons of ore containing 11,659.91 ounces of gold, 147,051 ounces of silver, 4,358,304 pounds of lead, and 20,491 pounds of zinc, which sold for $252,554 compared with $832,348 in 1930. After mine operating expenses, freight on ore shipments, and other miscellaneous expenses were deducted an operating profit of $46,998 remained. Gross income was $66,085, and after $19,046 was deducted for depreciation and Federal taxes net income was $47,039. No dividends were paid in 1931. On December 31 the surplus was $1,293,261.

According to the printed annual report of the Tintic Standard Mining Co. for the year ended December 31, 1931, the Tintic Standard mine produced 66,225 dry tons of lead ore and 11,613 dry tons of siliceous ore. These ores contained 2,992.21 ounces of gold, 1,991,518 ounces of silver, 27,966,345 pounds of lead, and 424,660 pounds of copper, which sold for $1,869,200 compared with sales of $2,790,680 in 1930. The output of metals, especially silver and lead, in 1931 decreased considerably from 1930. After smelter and freight charges of $1,079,981 were deducted the net smelter returns were $789,219. Income from other sources was $316,338, making the total income for the year $1,105,557. After $745,635 was deducted for various expenses a net profit of $359,922 was carried to surplus account. Surplus on December 31, 1931, was $8,109,386. Dividends of $461,326 were paid in 1931, making a total of $14,286,557 since the initial dividend was paid in June 1917. In 1931 the Tintic Standard Mining Co. was again the largest producer of silver in Utah and ranked second in production of lead.

The Eureka Standard mine, controlled by the Tintic Standard Mining Co., increased its output of gold ore from 28,459 tons in 1930 to 36,622 tons in 1931; the increase in gold output from 30,540.37 to 48,206.57 ounces prevented a much larger decrease in the State total. Besides gold the ore contained 452,251 ounces of silver, 293,969 pounds of copper, and 886,337 pounds of lead. Gross proceeds from all metals were $1,186,516, and after smelter and freight charges of $260,902 were deducted net smelter returns were $925,614. Other income ($4,161) made a total income of $929,775. After $453,373 was deducted for miscellaneous expenses, including depreciation and taxes, a net profit of $476,402 was carried to surplus account. Surplus on December 31, 1931, was $984,446. The Eureka Standard Consolidated Mining Co. paid dividends in 1931 amounting to $179,951, making a total of $269,926 since the initial dividend was paid in September 1930. The mine ranked second in production of gold in Utah in 1931 and fifth in silver.

The Eureka Lilly Mining Co., controlled by the Chief Consolidated Mining Co., produced 7,891 dry tons of ore containing 3,025 ounces of gold, 24,174 ounces of silver, 5,476 pounds of copper, and 544,553 pounds of lead. The net smelter returns were $48,090, and after various charges were deducted the loss was $7,627. Most (6,598 tons) of the output was siliceous gold ore of smelting grade; nearly all the remainder was first-class oxidized silver-lead ore. The ore output represents a decided decrease from 32,181 dry tons in 1930; the gold output decreased more than 10,500 ounces, silver more than 119,000 ounces, and lead more than 5,000,000 pounds.

The Tintic Bullion property directly west of the North Lily mine was operated in 1931 under lease by the North Lily Mining Co. A total of 369 tons of sulphide lead-zinc ore was shipped to the International flotation plant.

West Tintic district.—The output of the West Tintic district was oxidized lead ore containing considerable gold and silver from the Scotia mine 15 miles northwest of Jericho. The property was operated continuously by lessees who shipped more than 500 tons of first-class ore to the smelter at Murray. Besides the gold, silver, and lead recovered at a lead plant the ore contained about 23 percent iron and 10 percent arsenic.

MILLARD COUNTY

A little gold was recovered from placer claims near Notch Peak in the House Range southwest of Delta.

PIUTE COUNTY

The value of the production of metals in Piute County increased from $2,629 in 1930 to $7,682 in 1931, chiefly as a result of gold ore shipments from the Deer Trail mine in the Mount Baldy district and from the Annie Laurie group in the Gold Mountain district.

Gold Mountain district.—The Annie Laurie and Sevier-Miller groups, owned by the Annie Laurie Consolidated Gold Mines, were the only producers in the Gold Mountain district in 1931. The district extends into Sevier County to the north, and about half of its output in 1931 came from that section. Both groups were operated by lessees who shipped several cars of first-class gold ore to smelters near Salt Lake City.

Mount Baldy district.—The Deer Trail mine near Marysvale was operated by lessees who shipped more than 100 tons of first-class gold ore to the smelter at Garfield; a small quantity of rich gold ore was treated by pan amalgamation, and bullion valued at about $345 was marketed.

Ohio district.—Three mines in the Ohio district produced 86 tons of ore and 173 tons of old tailings yielding $1,144 in gold, 1,950 ounces of silver, 1,697 pounds of copper, 13,587 pounds of lead, and 835 pounds of zinc, valued in all at $2,399. Most of the output was old tailings from the Bully Boy dump, containing chiefly gold and silver; from the Bully Boy mine one car of first-class lead ore was shipped to a smelter and a little lead-zinc ore was milled in the custom flotation plant at Midvale. Lessees operating the Gold Strike group shipped several small lots of rich gold ore. One car of first-class silver-lead ore was shipped from the property of the Bullion Canyon Gold Mining & Milling Co.

SALT LAKE COUNTY

Salt Lake County, chiefly the Bingham district, has been the most important mining center of Utah since 1905. The value of the metal output of the county in 1931 was $20,903,609, a marked decrease (36 percent) from $32,731,343 in 1930. The continued drop in metal prices, combined with marked curtailment by several of the regular producers, caused the decrease. The value of the copper output alone fell more than $9,320,000.

The mines of Bingham have been large producers since the early days of mining in Utah. Their output increased decidedly after the Utah Copper Co. started steam-shovel mining in 1907, and in 1929 a record production of nearly 312,000,000 pounds of copper was made. In 1930 the district copper output decreased to 175,069,746 pounds, and in 1931 to 147,706,141 pounds.

Big and Little Cottonwood districts.—The production of the mines at the head of Little Cottonwood Canyon and of those in Big Cottonwood Canyon has been combined in the following table.

Mine production of gold, silver, copper, lead, and zinc in Big Cottonwood and Little Cottonwood districts, Utah, 1930 and 1931, and total, 1867–1931, in terms of recovered metals

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1930	7	1,491	$1,264	15,779	25,646	250,180	---------	$23,182
1931	10	657	3,177	20,317	10,306	234,943	13,017	19,194
Total, 1867–1931	-------	607,026	571,379	16,457,006	15,841,139	231,952,688	784,221	33,345,421

Six lode mines in the Big Cottonwood district produced 268 tons of ore yielding $569 in gold, 4,298 ounces of silver, 2,765 pounds of copper, and 61,376 pounds of lead, valued in all at $4,337, compared with a district output of $7,214 from three mines in 1930. One car of lead concentrates from former milling operations at the Maxfield mine was shipped in 1931, as well as 1 car of first-class smelting ore. First-class lead ore was also shipped from the Cardiff, Prince of Wales, and Confidence mines; a little copper ore containing considerable gold was produced from the Golden Porphyry mine; and a small lot of gold ore was produced from the Silver King claim.

In the Little Cottonwood district four lode mines produced 389 tons of ore yielding $2,608 in gold, 16,019 ounces of silver, 7,541 pounds of copper, 173,567 pounds of lead, and 13,017 pounds of zinc, valued in all at $14,857, or $38.19 in metals a ton. Most (292 tons) of the output was silver-lead ore of smelting grade from the Flagstaff (Mineral Veins Coalition Mines Co.) and Columbus Rexall mines; in addition to the first-class ore each mine produced a little lead-zinc ore which was treated in the custom flotation mill at Midvale. The Clementine mine was operated by a lessee who shipped several small lots of ore containing more than 1 ounce of gold to the ton. A small lot of high-grade carbonate lead ore from the West Toledo mine was shipped to Murray for smelting.

Bingham or West Mountain district.—Sixteen lode mines in the Bingham district in 1931 produced ore yielding on the average $2.40 in metals a ton compared with $3.19 in 1930. The ore of smelting grade (75,228 tons) consisted chiefly of copper and lead sulphides; it yielded 9,794.78 ounces of gold, 307,929 ounces of silver, 2,739,756 pounds of copper, and 6,718,642 pounds of lead, valued in all at $789,683, or $10.50 in metals a ton. The milling ore (8,410,626 tons) produced 374,818 tons of copper, lead, zinc, iron, and lead-zinc concentrates yielding 96,896.76 ounces of gold, 2,194,081 ounces of silver, 139,572,322 pounds of copper, 60,475,093 pounds of lead, and 53,215,489 pounds of zinc, valued in all at $19,600,166, or $52.29 in metals to a ton of concentrates. In addition copper precipitates recovered from mine water and from leaching of ore in place yielded 5,386,279 pounds of copper valued at $490,151; old mill clean-up smelted yielded metals valued at $4,319; and one placer yielded gold bullion valued at $44.

Mine production of gold, silver, copper, lead, and zinc in Bingham or West Mountain district, Utah, 1930 and 1931, and total, 1865–1931, in terms of recovered metals

Year	Mines producing	Ore, etc.	Gold	Silver	Copper [1]	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1930	20	10, 134, 900	$2, 187, 614	3, 517, 117	[2] 175, 069, 746	85, 172, 500	44, 724, 792	$32, 706, 186
1931	17	[3] 8, 485, 873	[4] 2, 209, 151	2, 502, 057	[5] 147, 706, 141	67, 193, 735	53, 215, 489	20, 884, 363
Total, 1865–1931	-------	(6)	[4] 60, 171, 194	[4] 85, 883, 831	4, 318, 047, 623	2, 115, 498, 665	381, 974, 313	969, 283, 827

[1] Includes copper saved from precipitates.
[2] Includes 3,189,620 pounds of copper saved from precipitates.
[3] Includes 19 tons of old mill cleanings sold to a smelter.
[4] Includes placer production.
[5] Includes 5,386,279 pounds of copper saved from precipitates.
[6] Figures not available.

NOTE.—Total dividends, 1865–1931, $242,889,503.

Mine production of gold, silver, copper, lead, and zinc in Bingham or West Mountain district, Utah, in 1931, by classes of ore, in terms of recovered metals

Class of ore	Lode mines producing	Ore, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	7	1,912	827.75	25, 374	29, 568	64, 201	-----------
Copper	7	[1] 8, 202, 609	61, 313.87	633, 581	[2] 145, 982, 239	529, 240	-----------
Lead	11	18, 417	1, 948.16	183, 561	265, 675	6, 118, 701	-----------
Copper-lead	1	73	3.00	184	7, 241	6, 500	-----------
Lead-zinc	10	262, 862	42, 772.76	1, 659, 357	1, 421, 418	60, 475, 093	53, 215, 489
	[3] 16	8, 485, 873	106, 865.54	2, 502, 057	147, 706, 141	67, 193, 735	53, 215, 489

[1] Includes 19 tons of old mill cleanings sold to a smelter.
[2] Includes 5,386,279 pounds of copper saved from precipitates.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

According to its annual statement the Utah Copper Co.[3] produced 8,147,764 tons of copper ore, a marked decrease from 9,552,500 tons in 1930; the ore contained 0.961 percent copper (19.22 pounds a ton). This low-grade material was mined by electric shovels and treated at the Magna flotation plant; the Arthur plant remained idle throughout the year. Metals recovered from concentrates during 1931, together with 4,544,013 net pounds of copper recovered from mine-water precipitates, amounted to 142,694,917 pounds of copper, 54,123.77 ounces of gold, and 481,251 ounces of silver, valued in all at $11,548,245, compared with $20,698,585 in 1930. In 1931 the company was, as usual, the largest producer of copper and gold in Utah. The copper concentrates shipped to the smelter contained 142,756,877 pounds of copper (32.61 percent) in 1931 compared with 165,444,216 pounds (32.25 percent) in 1930. Although the average copper content (0.961 percent) of the milling ore was the lowest for any year in the history of the company, the average recovery (91.16 percent) in the form of concentrates was a record for the 25-year period. The average milling cost was 39.27 cents a ton, a decrease from 46.09 cents in 1930. The actual direct mining cost of all ore, exclusive of stripping charges, was 18.56 cents a ton, of which 12.44 cents represents all mine charges; the remainder (6.12 cents) represents overhead expense.

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[3] Utah Copper Co., Twenty-Seventh Ann. Rept., for year ended Dec. 31, 1931.

The average cost per net pound of copper, including depreciation of plant and equipment and all fixed and general expenses (except Federal taxes) and after gold, silver, and miscellaneous earnings were credited, was 6.99 cents compared with 8.47 cents for 1930, computed on the same basis. The value of the gold and silver recovered and the miscellaneous earnings amounted to 1.02 cents per pound of copper compared with 1.23 cents for 1930. Copper precipitates shipped in 1931 from the plant at the mouth of Bingham Canyon contained 4,544,013 net pounds of copper, a decided increase from 1,055,291 pounds in 1930.

After all operating charges of production, including the cost of marketing refined copper, were deducted the direct profits from mining operations for the year were $698,153, compared with $6,501-452 in 1930. Indirect earnings for the period, accruing as miscellaneous income incident to operations in Utah, were $231,546 which, with income of $1,776,554 from outside investments, made a total income of $2,706,253 compared with $10,391,306 in 1930. The audit report shows deductions for other charges, including depreciation of plant and equipment and obsolescence or retirement of property, aggregating $679,104, leaving a net income carried to surplus account of $2,027,149, approximately $1.25 per share of capital stock outstanding. Dividends paid to stockholders in 1931 were $6 a share ($9,746,940 in all). The aggregate distribution to stockholders to December 31, 1931, was $228,472,943.

The output of the United States Smelting, Refining & Mining Co. mines[4] at Bingham (United States and Lark groups) was about 213,000 tons of ore in 1931, a decrease of about 103,000 tons from 1930. The largest decreases were in output of lead-zinc milling ore from the Lark group and in copper ore of smelting grade from the United States group. More than 93 percent of the total was lead-zinc ore from the United States group treated in the flotation plant at Midvale, where the galena-sphalerite-pyrite ore is reduced to lead, zinc, and iron concentrates. This group was by far the largest producer of lead and zinc in Utah in 1931 and ranked third in production of gold and silver. The output of each of the four metals was considerably greater than in 1930. The United States group was one of the few properties in Utah operated at normal rate when metal prices were unusually low. The large output of lead-zinc ore from the property prevented a much larger decrease in the State production of gold, silver, lead, and zinc. Development in 1931 comprised 11,951 feet of drifting, 2,784 feet of raising, and 82 feet of sinking.

The output of ore from the Lark group of the United States Smelting, Refining & Mining Co. decreased from about 79,300 tons in 1930 to about 9,200 tons in 1931, as the property was closed January 15 except for development. The output in both years was nearly all lead-zinc ore treated in the custom flotation mill at Midvale. There was a notable decrease in production of all metals, especially silver, lead, and zinc. Development in 1931 totaled 11,178 feet of drifting and 1,392 feet of raising.

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[4] United States Smelting, Refining & Mining Co., Twenty-Sixth Ann. Rept., for year ended Dec. 31, 1931.

Details on production and developed ore reserves are not published in the company's printed annual report, but the statement given to the industrial commission credited both groups (United States and Lark) with an output of 212,892 tons of first-class and milling ore containing 28,970.00 ounces of gold, 1,164,760 ounces of silver, 1,517,484 pounds of copper, 47,750,588 pounds of lead, and 53,539,975 pounds of zinc. Gross proceeds were $1,825,283; and after various expenses, including cost of extraction, freight and smelter charges, and cost of construction, were deducted the net loss was $209,507.

One principal feature of the Utah metal-mining industry in 1931 was the unusually large output of lead-zinc ore containing considerable gold from the Niagara property, controlled and operated by the United States Smelting, Refining & Mining Co.; the output increased from 11,038 tons in 1930 to 39,402 tons in 1931. The ore was treated in the custom flotation mill at Midvale where lead, zinc, and iron concentrates were made. Production of all metals, especially gold, lead, and zinc, increased decidedly. According to a report to the industrial commission the mine produced 39,402 tons of ore containing 13,426 ounces of gold, 350,756 ounces of silver, 304,156 pounds of copper, 8,172,819 pounds of lead, and 9,445,143 pounds of zinc. Gross proceeds were $464,393; and after $345,070 was deducted for extraction, transportation, reduction, and construction net proceeds were $119,323.

The Utah-Delaware Mining Co. worked the Highland Boy and Yampa groups at the head of Carr Fork and produced 33,012 tons of ore, a decided decrease from 87,414 tons in 1930. Although the output of copper ore decreased more than 52,000 tons from 1930, 79 percent of the total output in 1931 was copper ore of smelting grade; the remainder was lead-zinc ore treated in the flotation mill at International. The property was operated throughout the year but at greatly reduced rate, and production of all metals was consequently much less than in 1930. Gross proceeds from sale of ore were $294,884 compared with $809,049 in 1930. After charges for extraction, transportation, reduction, construction, and repairs were deducted the net loss was $101,842.

The Utah-Apex Mining Co. worked its mine continuously in 1931, but its output of ore decreased 69,113 tons from 1930 as a result of low metal prices. Output of lead-zinc milling ore decreased more than 35,000 tons, and there was a large decrease in output of copper ore. The curtailment resulted in a decided decrease in production of all metals. According to a report to the Bureau of Mines for the calendar year 1931 the company produced 32,761 tons of ore. Nearly all—31,729 tons (21,154 tons of copper ore and 10,575 tons of lead ore)—was first-class ore; the remainder—1,032 tons of lead-zinc ore—was milled in the flotation plant at International. The 700-ton company flotation mill at Bingham was idle the entire year. The ores contained 1,205.47 ounces of gold, 81,862 ounces of silver, 1,228,390 pounds of copper, 3,879,365 pounds of lead, and 1,698,882 pounds of zinc. Gross proceeds were $172,310; and after $315,633 was deducted for various costs, chiefly extraction, the net loss was $143,323.

Leaching of ore in place continued during 1931 at the Ohio Copper Co. property at Lark, but production of copper decreased from 2,048,369 pounds in 1930 to 659,213 pounds in 1931. No development was done on the 700-foot level in the limestone area of the mine, and no efforts were made to treat material from the large tailings dump at Lark. Work for the year resulted in a loss of $44,963, and the property was closed November 1.

The property of the Utah Metal & Tunnel Co. was closed in July, and the output of ore decreased from 18,783 tons in 1930 to 9,612 tons in 1931; the largest decrease was in output of lead-zinc ore of milling grade. About 61 percent of the total in 1931 was lead-zinc ore carried by an aerial tramway to International for milling; the remainder was first-class copper ore of smelting grade. The leasing contract with the Utah-Delaware Mining Co. was canceled November 2, but the American Smelting & Refining Co. took a 20-year lease below the 1,000-foot level of the mine.

The Bingham Prospect Mining Co. operated its property near Lark the entire year and shipped 3,391 tons of ore, a decrease of 8,195 tons from 1930. Seventy percent of the output in 1931 was first-class silver-lead ore of smelting grade; the remainder consisted of lead-zinc ore treated in the custom flotation mill at Midvale and siliceous silver ore shipped to Garfield for smelting. Production of all metals, especially silver, lead, and zinc, decreased decidedly. The property was sold early in 1932 to the United States Smelting, Refining & Mining Co.

The output of ore from the New England property of the Bingham Metals Co. was slightly more than in 1930, but production of all metals except gold and copper decreased. The output in 1931 was about 1,600 tons, chiefly siliceous gold ore of smelting grade.

The Silver Shield and Bully Boy properties, owned by the Park-Bingham Mining Co., were operated under lease most of the year by the Bonanza Mining Co. The output of ore increased from 1,859 tons in 1930 to about 3,000 tons in 1931, but production of each of the five metals (except lead, which increased more than 220,000 pounds) was virtually the same as in 1930. Most of the output was lead-zinc ore treated in the flotation mill at Midvale.

Other producers in the West Mountain district were the Bingham Bemis, Montana-Bingham Consolidated, Queen (Lavagnino), Bingham Premier, and Osceola-Lucky Boy properties.

Smelter district (*Midvale and Murray*).—The output of the Smelter district in 1931 was 2 tons of old matte containing silver and copper.

The lead smelter of the United States Smelting, Refining & Mining Co. at Midvale was the only smelter in Utah that ran at normal rate in 1931. Bullion output decreased from about 37,000 tons in 1930 to about 34,000 tons in 1931. Besides lead bullion, the company shipped lead-copper matte, refined arsenic, weed killer, and cadmium.

The 1,000-ton flotation plant at Midvale, owned by the United States Smelting, Refining & Mining Co., treated an average of 724 tons of lead-zinc-iron ore a day, a decrease of more than 150 tons from 1930.

The American Smelting & Refining Co. operated its lead plant at Murray 9 months in 1931; it was closed during the summer because of decrease in ore receipts. Lead bullion is shipped East for refining, lead-copper matte to the company copper plant at Garfield, Utah, and arsenic dust to various consumers in the West and Middle West. The plant, which has operated more than 23 years, was described in the Engineering and Mining Journal in May 1930.

SEVIER COUNTY

The Sevier-Miller property in the Gold Mountain district was the only producer in Sevier County in 1931. The property, owned by the Annie Laurie Consolidated Gold Mines, was operated by lessees who shipped three cars of gold ore to Garfield for smelting.

SUMMIT AND WASATCH COUNTIES

PARK CITY REGION

The Blue Ledge and Snake Creek districts in Wasatch County and the Uintah district in Summit County represent the producing area of the Park City region.

Mine production of gold, silver, copper, lead, and zinc in Park City region, Utah, 1930 and 1931, and total, 1870–1931, in terms of recovered metals

Year	Mines producing	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1930	10	[1] 456,387	$360,282	4,212,403	1,678,415	61,749,780	39,085,269	$7,163,833
1931	10	186,521	104,208	2,124,177	818,545	34,736,616	18,871,329	2,797,072
Total, 1870–1931	-------	(2)	8,153,392	201,525,755	54,880,694	1,993,307,985	351,177,716	290,424,793

[1] Includes 100,565 tons of old tailings.

[2] Figures not available.

NOTE.—Total dividends, 1870–1931, $64,277,722.

Mine production of gold, silver, copper, lead, and zinc in Park City region, Utah, in 1931, by classes of ore, in terms of recovered metals

Class of ore	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	1	63	1.16	2,269	277	350	------------
Lead	4	588	32.00	15,187	4,272	249,158	------------
Lead-zinc	7	185,870	5,007.90	2,106,721	813,996	34,487,108	18,871,329
	[1] 10	186,521	5,041.06	2,124,177	818,545	34,736,616	18,871,329

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

Production of gold, silver, copper, lead, and zinc in the Park City region was decidedly less in 1931 than in 1930, following a pronounced decrease from 1929 to 1930. The largest decrease was in output of lead-zinc ore from the Park Utah mine of the Park Utah Consolidated Mines Co., closed in March as a result of unusually low metal prices. There was also a large decrease in output of lead-zinc ore from the Silver King Coalition property. The 800-ton flotation plant of the Silver King Coalition Mines Co. and the Judge mill, which treated lead-zinc ore from the Daly Judge and Daly West mines, were operated on a restricted basis.

The Silver King Coalition Mines Co.[5] produced 112,704 tons of mill ore and lessees mined 74 tons of first-class ore, 112,778 tons in all. The output of milling ore decreased nearly 28 percent from 1930, resulting in a decided decrease in production of each of the five metals. After smelter and freight charges were deducted the company received $1,200,594 from sale of concentrates and $155 from royalty from lessees' ore, a total of $1,200,749 compared with $2,403,733 in 1930; after other income was added total income for 1931 was $1,241,980. After $1,215,131 was deducted for operating expenses (including taxes) a profit of $26,849 remained before $36,986 was allowed for depreciation; net loss carried to surplus was $10,137 compared with a net income of $544,533 in 1930. Surplus on December 31, 1931, was $2,657,553. Milling ore yielded 19,086 tons of lead concentrates and 10,043 tons of zinc concentrates containing 2,200.65 ounces of gold, 1,529,625 ounces of silver, 792,269 pounds of copper, 26,076,330 pounds of lead, and 12,292,038 pounds of zinc. First-class smelting ore (lessees' ore) contained 2.82 ounces of gold, 1,611 ounces of silver, 741 pounds of copper, and 40,530 pounds of lead. The mine ranked second in production of silver and zinc in Utah in 1931 and third in lead.

More than 25,000 feet of development were done in 1931, chiefly in drifting. A dividend of $183,070 was paid in January, making a total of $25,307,072 paid since August 1907; dividends were discontinued in 1931 after the January payment.

The Park Utah Consolidated Mines Co. operated the Park City unit consisting of the Daly West and Daly Judge properties continuously but the Park Utah unit near Keetley on a production basis for 2 months only. Output of lead-zinc ore from the Park Utah mine decreased from 104,741 tons in 1930 to 17,270 tons in 1931, resulting in a decrease of more than 14,000 ounces in gold, 958,455 ounces in silver, 512,961 pounds in copper, 11,185,834 pounds in lead, and 13,676,775 pounds in zinc. These unusually large decreases accounted for a considerable part of the decline in output of gold, silver, lead, and zinc in Utah. The entire output of lead-zinc ore in 1931 was shipped to International for milling and was reduced to lead concentrates, zinc concentrates, and iron concentrates. The Judge concentration mill in Empire Canyon treated lead-zinc ore from the Daly West and Daly Judge mines; but 34 percent less was treated in 1931 than in 1930, and production of all five metals was correspondingly less. The products of the mill are lead concentrates, shipped to International for smelting, and lead-zinc-iron middlings, re-treated by flotation at International. Besides milling ore the company shipped several hundred tons of first-class silver-lead ore to Murray for smelting. Both mines were worked throughout the year; and development consisted of about 16,000 feet, chiefly in drifting and raising.

The Park Utah Consolidated Mines Co. received $309,804 in 1931 from sale of ore and $108,258 from other income, $418,062 in all.

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[5] Silver King Coalition Mines Co., Ann. Rept. for year ended Dec. 31, 1931.

After $800,130 was deducted for mining costs, development, milling, etc., there was a net loss of $382,068 before depreciation and depletion. After $91,332 was deducted for depreciation, net loss for the year (exclusive of depletion) was $473,400.

The Park City Consolidated Mines Co., owning and leasing properties in Wasatch and Summit Counties, shipped 13,451 tons of ore during the first 5 months of 1931, a decrease of 5,183 tons from 1930; shipments of ore were suspended in May due to the abnormal drop in price of silver. The output in 1931 was low-grade lead-zinc ore treated in the custom flotation mill at Midvale and contained 284.18 ounces of gold, 298,252 ounces of silver, 237,368 pounds of lead, and 406,046 pounds of zinc. The company received $36,445 from sale of ore after $21,444 was deducted for freight, royalty, etc., compared with $66,233 in 1930.

The Park Galena Mining Co. operated its property 3 miles south of Keetley on a production basis for 1 month (January) only and shipped 230 tons of lead-zinc ore to Midvale for milling. Output of ore and production of all metals decreased decidedly from 1930, when the company shipped 4,772 tons of ore.

The output of ore from the New Quincy property also decreased decidedly—from about 3,000 tons in 1930 to 71 tons in 1931; the mine was operated chiefly on development.

Other producers in the Park City region were the Three Kings and the Daly properties.

No old tailings were treated or sold in 1931.

TOOELE COUNTY

In Tooele County 19 lode mines and 1 dump produced 46,597 tons of ore and 3,000 tons of old tailings, an increase of 3,871 tons over the output from 15 mines in 1930. The recovered gold increased from $90,129 to $98,234 and zinc from 715,042 to 1,211,553 pounds; silver decreased from 305,969 to 258,886 fine ounces, copper from 222,670 to 71,908 pounds, and lead from 20,660,980 to 18,054,684 pounds. The total value of the metals decreased from $1,304,245 to $893,917. Nearly 95 percent of the ore was produced from the properties of the Bluestone Lime & Quartzite Mining Co. and the Combined Metals Reduction Co. at Bauer. The largest producer of gold, silver, copper, and lead in the county was the Cyclone-Tip Top property of the Bluestone Lime & Quartzite Mining Co.

At International west of Bingham the International Smelting Co., a subsidiary of the Anaconda Copper Mining Co., continued to operate its 1,200-ton flotation mill on sulphide ore, its 150-ton oxide mill, and its copper and lead smelting plants intermittently on custom ore and concentrates. The total of all ore receipts at the various plants at International in 1931 was only half that in 1930, following an unusually large drop in receipts in 1930. The substantial decreases in receipts of lead-zinc ore at the sulphide mill and first-class lead ore at the lead-smelting plant were especially notable.

In 1931 the custom sulphide flotation plant at International treated about 45,000 tons of ore (from Utah and Colorado), a marked decrease from 196,000 tons in 1930; about 68 percent of the total in 1931 was lead-zinc ore and middlings from the Park City region, and nearly all the remainder was lead ore and lead-zinc ore from the Bingham district. The resulting lead concentrates and iron concentrates are smelted locally, but the zinc concentrates are shipped to Anaconda and Great Falls, Mont. The flotation plant for oxidized ore treated about 43,000 tons of oxidized silver-lead ore from the Tintic district.

In 1931 the copper-smelting plant treated nearly 32 percent less copper material than in 1930 and the lead-smelting plant 45 percent less lead material. Most of the copper material came from Utah, California, and Nevada and most of the lead material from Utah and Nevada. Metals recovered from material treated in 1931 are not given separately for the two smelting plants, but the Anaconda Copper Mining Co. in its annual report for 1931 states that the lead plant produced from custom ores 10,808.66 ounces of gold, 2,027,791 ounces of silver, and 52,190,356 pounds of lead. This output represents a large decrease from 1930, when the plant produced 28,299.92 ounces of gold, 4,543,645 ounces of silver, and 107,860,121 pounds of lead. Production from the copper plant was combined with the output from the International Smelting Co. copper plant at Miami, Ariz.

Camp Floyd (Mercur) district.—In 1931 gold bullion was produced from the Camp Floyd (Mercur) district for the first time since 1918. From 1890 to the end of 1917 the district produced $19,035,512 in gold from the treatment by cyanidation of 5,583,983 tons of ore and old tailings. In 1931 lessees treated by cyanidation about 3,000 tons of old tailings from the Manning dump and recovered gold bullion valued at $3,031.

Clifton district (Gold Hill).—Ten lode mines in the Clifton district produced 2,259 tons of ore yielding $23,615 in gold, 2,384 ounces of silver, 22,046 pounds of copper, and 458,723 pounds of lead, valued in all at $43,285, or $19.16 in metals a ton compared with a district output valued at $23,284 in 1930. The improvement was due chiefly to increased shipments of gold ore, largely from the Rube No. 3 (Palmer) mine which produced 189 tons of first-class ore yielding gold valued at more than $16,000; several hundred tons of first-class gold ore were also shipped from the Alvarado and Cane Springs mines. The Garrison mine, under lease, produced more than 1,000 tons of first-class lead ore, and lessees working the Rube lead group shipped 332 tons of oxidized lead ore to the smelter at Murray. Oxidized copper ore of smelting grade was shipped from the Frankie, Monocco, Yellow Hammer, Gold Queen, and Wilson properties.

Columbia district.—The Benmore group near Lofgreen was worked a short time in 1931; one car of oxidized lead ore was shipped to the smelter at Murray, and several cars of ferruginous manganese ore were shipped to the plant of the Columbia Steel Co. near Provo.

Free Coinage district.—The Salt Lake & Mamie group of the Utah Bunker Hill Mining Co. and the Humdinger group of the Lead Ore Mining Co. 6 miles west of Grantsville in the Stansbury Range were operated most of the year on development. In the course of the work a small quantity of oxidized lead ore from each property was shipped to Murray for smelting.

Lakeside district.—One car of oxidized lead ore of smelting grade from the Monarch mine near Delle was shipped by a lessee.

Ophir district.—The metal production of the Ophir district was valued at $2,271 in 1931 compared with $4,712 in 1930. Nearly all the output in 1931 was lead-zinc ore from the Ophir Hill property operated by the Western Exploration Co. The company shipped about 127 tons of ore to the flotation mill of the Combined Metals Reduction Co. at Bauer, where it was reduced to lead concentrates and zinc concentrates. The Ophir mine was operated by a lessee who shipped 6 tons of high-grade silver ore to the smelter at International.

Rush Valley district (*Stockton*).—Three lode mines in the Rush Valley district produced 44,112 tons of ore yielding $71,576 in gold, 254,475 ounces of silver, 49,634 pounds of copper, 17,546,800 pounds of lead, and 1,190,807 pounds of zinc, valued in all at $844,374, or $19.14 in metals a ton. The output of each metal except zinc decreased from 1930, when 44,561 tons of ore yielded metals valued at $1,274,538. All the output in 1931 except 8 tons of oxidized lead ore from the Ute group came from the Cyclone-Tip Top group of the Bluestone Lime & Quartzite Mining Co. and the Honerine and Galena King groups of the Combined Metals Reduction Co.

The Bluestone Lime & Quartzite Mining Co. worked its property continuously throughout the year and shipped 29,465 tons of first-class sulphide lead ore to International for smelting and about 100 tons of lead-zinc ore to the flotation mill of the Combined Metals Reduction Co. at Bauer. The company paid dividends totaling $600,000 in 1929 and 1930 but none in 1931.

The Combined Metals Reduction Co. operated the Honerine and Galena King groups continuously and produced more than 14,000 tons of ore, a decrease of about 2,000 tons from 1930. Most (11,505 tons) of the output was lead-zinc ore treated in the company flotation plant at Bauer; the remainder consisted of first-class lead ore of smelting grade and lead ore concentrated in a jigging plant. Production of lead decreased nearly 2,000,000 pounds from 1930, and silver and copper also decreased; gold and zinc increased slightly. The flotation plant at Bauer was operated most of the year on a greatly curtailed basis and treated about 59,500 tons of lead-zinc ore from Utah and Nevada. Nearly 75 percent of the total treated came from company property at Pioche, Nev.

UINTAH COUNTY

The output of Uintah County in 1931 consisted of a test lot of crude copper ore from the Carbonate district near Vernal and a small quantity of placer bullion from the banks of Green River east of Vernal.

UTAH COUNTY

The value of the mine production of metals in Utah County decreased from $5,241,996 in 1930 to $3,441,416 in 1931 but was greater than in any other county in the State except Salt Lake. The value of the lead output alone dropped more than $1,200,000, and that of silver was also much lower than in 1930. These decreases were due chiefly to curtailment in output of ore from the North Lily, Eureka Lilly, and Tintic Standard mines. The marked increase in shipments of siliceous gold ore from the Eureka Standard mine near Dividend and of copper ore containing considerable gold from the Live Yankee mine near American Fork prevented a larger decrease in the total value of the county output.

American Fork district.—The Live Yankee mine of the American Smelting & Refining Co. was the only important producer in the American Fork district in 1931. Its output of 5,594 tons of first-class sulphide copper ore was a marked increase over the 220 tons of similar material shipped in 1930. The ore was shipped in June and July, as the mine was closed while the 4-mile tramway from the mine to Deer Creek landing was under construction. The predominant minerals are pyrite and chalcopyrite; but the ore is valuable chiefly for its gold, which averaged 0.57 ounce to the ton in 1931. The only other producer in the American Fork district in 1931 was the Blue Rock property owned by the Pacific Gold Mining & Milling Co. Lessees operated the property and shipped two cars of silver-lead ore to Murray for smelting.

Mine production of gold, silver, copper, lead, and zinc in American Fork district, Utah, 1930 and 1931, and total, 1870–1931, in terms of recovered metals

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1930	2	252	$2, 446	1, 291	8, 639	19, 260	---------	$5, 029
1931	2	5, 671	66, 315	17, 836	247, 007	69, 500	---------	96, 537
Total, 1870–1931	-------	105, 238	618, 388	2, 067, 763	1, 276, 943	31, 981, 536	313, 926	4, 776, 065

Tintic district.—The following mines, in Utah County in the eastern part of the Tintic district, are mentioned in the general review under Juab County: Tintic Standard, North Lily, Eureka Standard, Eureka Lilly, and Tintic Bullion.

WASHINGTON COUNTY

The output of Washington County in 1931 consisted of a sample of gold ore from the Bull Valley (Gold Strike) district and 1,137 tons of first-class oxidized copper ore containing 33 percent copper from the Dixie (Apex) mine in the Tutsagubet district. The mine is near St. George; the ore is hauled 80 miles north to Cedar City, the nearest shipping point on the Los Angeles & Salt Lake Railroad.

COPPER[1]

By C. E. Julihn and H. M. Meyer

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GENERAL SUMMARY

Throughout 1931 the copper industry continued the decline which characterized it in 1930. World consumption of the metal decreased below that in 1924. Production was further curtailed but not sufficiently nor with the promptness required to prevent a large increase in stocks. The price of copper declined accordingly and passed the critical point beyond which it retains slight relation to cost of production but is determined rather by pressure for sales of distress metal. The New York price was 10.375 cents a pound at the beginning of the year, 6.125 cents in November, and 7.125 cents at the end of the year. These relations are illustrated as follows:

	Index (1926–30 average=100)	
	1930	1931
World production	96.5	83.5
World consumption	92.3	75.7
Stocks in North and South America, Great Britain, Havre, and Japan at end of year	139.4	176.5
Average price in United States (f.o.b. refinery)	90.3	63.2

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[1] Work on manuscript completed December 1932.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

WORLD PRODUCTION

From official reports the Bureau of Mines estimated the world smelter production of new copper in 1931 as 1,363,000 metric tons, a decrease of 14 percent from the 1,576,000 tons produced in 1930 and 28 percent from the record production in 1929. Production in the Western Hemisphere declined 190,700 tons (17 percent), whereas production elsewhere fell 21,400 tons (only 5 percent).

All continental areas except South America showed declines in production in 1931, as follows: North America 22 percent, Australia 13 percent, Africa 8 percent, and Europe and Asia each 3 percent; South America's production increased 2 percent. North America produced 50.5 percent of the world total in 1931 compared with 56.1 percent in 1930 and 59.3 percent in 1929. South America contributed 19.1 percent of the total in 1931 compared with 16.2 percent in 1930 and 18.8 percent in 1929. Africa has shown steady progress in importance as a copper producer; its percentage of the world total increased from 7.9 in 1929 to 9.6 in 1930 and 10.3 in 1931. Europe's percentage increased from 9.2 in 1929 to 11.8 in 1930 and 13.2 in 1931. Asia and Australia are of minor importance in world copper production.

In North America Canada increased its output in 1931 by 9,000 tons (9 percent), whereas the United States and Mexico declined 192,000 tons (26 percent) and 12,000 tons (23 percent), respectively.

The increase in South American production was due to an increase of 8,000 tons (4 percent) in Chile's output, offset to some extent by a decrease of 6 percent in production from Peru.

Among the principal European producers Germany and Great Britain showed substantial decreases, Yugoslavia and Belgium showed little change, and Spain and Russia increased their outputs.

Africa's decline was due to a decrease of 16,000 tons (12 percent) in production from the Belgian Congo. Northern Rhodesia and the Union of South Africa made substantial increases in 1931.

The decline in Asia was due largely to a 3 percent decrease in Japan.

The following table shows smelter production of copper by continents and countries during the past 5 years.

World smelter production of copper, 1927–31, in metric tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [1]	1927	1928	1929	1930	1931
North America:					
Canada [2]	31, 947	56, 619	72, 661	101, 554	110, 588
Mexico	39, 248	46, 865	57, 874	53, 094	41, 000
United States [3]	843, 850	911, 444	998, 789	729, 611	537, 175
	915, 045	1, 014, 928	1, 129, 324	884, 259	688, 763
South America:					
Chile	226, 160	274, 900	303, 188	208, 011	215, 696
Peru	[2] 46, 377	[2] 52, 292	[2] 53, 962	[2] 47, 287	44, 395
	272, 537	327, 192	357, 150	255, 298	260, 091

[1] In addition to the countries listed, copper is smelted in Asiatic Turkey, but data of output are not available.

[2] Copper content of blister produced.

[3] Smelter output from domestic and foreign material, exclusive of scrap. The production from domestic material only, exclusive of scrap, was as follows: 1927, 763,864 tons; 1928, 828,210 tons; 1929, 908,479 tons; 1930, 632,481 tons; 1931, 472,963 tons.

World smelter production of copper, 1927–31, in metric tons—Continued

Country	1927	1928	1929	1930	1931
Europe:					
Austria	3, 308	3, 424	3, 895	4, 076	3, 235
Belgium	9, 810	[4] 9, 720	[4] 8, 940	[4] 14, 640	[4][5] 15, 000
Czechoslovakia	743	1, 010	1, 694	1, 521	1, 215
Finland	354	375	235	[5] 200	[5] 200
France	1, 896	1, 142	1, 010	[5] 1, 000	[5] 1, 000
Germany [6]	50, 600	48, 500	53, 600	59, 200	55, 500
Great Britain [7]	22, 600	21, 400	23, 700	20, 200	[5] 17, 000
Italy	450	900	539	262	721
Norway	13	788	2, 400	5, 149	4, 352
Rumania [8]	215	104	143	169	[5] 200
Russia [9]	13, 597	18, 996	[5] 25, 000	[5] 26, 000	[5] 27, 000
Spain	28, 689	27, 758	28, 455	22, 996	25, 734
Sweden [10]	5, 406	3, 396	4, 748	5, 523	[5] 5, 000
Yugoslavia	12, 863	15, 086	20, 675	24, 463	24, 351
	150, 544	152, 599	175, 034	185, 399	180, 508
Asia:					
China [11]	1, 052	4, 395	3, 469	1, 203	157
Chosen	1, 004	607	547	589	[5] 500
India, British			1, 661	3, 022	[5] 4, 000
Japan	66, 571	68, 233	75, 469	79, 033	76, 408
	68, 627	73, 235	81, 146	83, 847	81, 100
Africa:					
Belgian Congo	89, 156	[12] 111, 510	[12] 135, 539	[12] 136, 404	[2] 120, 000
Rhodesia:					
Northern	3, 343	6, 026	5, 553	6, 370	9, 070
Southern		110	362	1, 334	538
Union of South Africa	9, 324	8, 849	9, 309	7, 488	10, 225
	101, 823	126, 495	150, 763	151, 596	139, 833
Oceania: Australia	9, 718	12, 048	11, 049	15, 139	13, 144
	1, 518, 000	1, 706, 000	1, 904, 000	1, 576, 000	1, 363, 000

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[2] Copper content of blister produced.

[4] Figures represent blister copper only. In addition to blister copper, Belgium reports a large output of refined copper which is not included above as it is believed produced principally from crude copper from the Belgian Congo and would, therefore, duplicate output reported under the latter country.

[5] Approximate production.

[6] Exclusive of material from scrap. (Metallgesellschaft, Stat. Zusammenstell.)

[7] Approximate production. (Imp. Inst., London.)

[8] Smelter output from domestic ores.

[9] Year ended Sept. 30.

[10] Exclusive of material from scrap.

[11] Exports of ingots and slabs.

[12] In addition to the crude copper smelted in the Belgian Congo, the following quantities were smelted in Belgium from matte and alloys produced in the Belgian Congo: 1928, 946 tons; 1929, 1,453 tons; 1930, 2,545 tons.

Owing to the fact that several countries, including Cuba, Northern Rhodesia, and South-West Africa, export substantial quantities of copper ore to smelting countries, mine production affords a more accurate picture of the geographical distribution of copper production than does smelter production. Unfortunately, however, complete official records of mine production are not available until long after the smelter record is complete. It is, therefore, impossible at this time to show complete records for 1931 in the following table, which gives mine production of copper by continents and countries during the past 5 years.

World mine production of copper, 1927–31, in metric tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [1]	1927	1928	1929	1930	1931
North America:					
Canada	63,569	91,941	112,545	137,655	132,586
Cuba [2]	13,433	6,431	4,604	11,798	9,523
Mexico	59,875	67,328	86,554	73,711	54,212
Newfoundland	------	------	------	1,000	[3] 1,400
United States	748,405	820,906	904,962	639,629	479,785
	885,282	986,606	1,108,665	863,793	677,506
South America:					
Argentina	[3] 800	------	------	------	------
Bolivia [4]	8,729	8,486	7,188	3,987	2,049
Chile	242,600	286,800	320,630	220,323	223,284
Peru	55,368	[5] 56,457	[5] 56,115	[6] 48,276	[6] 44,319
Venezuela	200	------	------	96	746
	307,697	351,743	383,933	272,682	270,398
Europe:					
Austria	2,332	3,035	2,081	2,216	1,313
Bulgaria [3]	1,300	1,000	2,000	2,000	1,000
Czechoslovakia	1,160	1,627	1,359	1,790	1,252
Finland	836	3,410	4,565	4,986	6,396
France	246	265	596	(7)	(7)
Germany	27,271	26,213	28,983	26,972	27,000
Great Britain	180	69	69	49	67
Greece	------	1	(8)	------	------
Italy	1,690	822	883	983	364
Norway	12,367	15,779	18,890	17,317	8,708
Portugal [3]	2,000	2,000	4,000	4,000	2,000
Rumania [9]	215	104	143	169	[3] 200
Russia [10]	[11] 14,400	[11] 20,200	[11] 26,000	[11] 37,000	(7)
Spain	49,600	54,200	63,700	58,400	54,000
Sweden	783	619	1,128	807	8,542
Yugoslavia	12,900	15,100	15,200	22,700	21,100
	[11] 127,280	[11] 144,444	[11] 169,597	[11] 179,389	(7)
Asia:					
China [12]	1,052	4,395	3,469	1,203	157
Cyprus [4]	4,275	4,900	5,900	5,200	4,060
India, British	5,100	5,500	7,200	11,800	11,600
Japan:					
Japan proper [9]	66,571	68,233	75,469	79,033	76,408
Chosen [9]	1,004	607	547	589	[3] 500
Taiwan	1,384	1,300	6,100	3,060	(7)
Russia	(11)	(11)	(11)	(11)	(7)
	[11] 79,386	[11] 84,935	[11] 98,685	[11] 100,885	(7)
Africa:					
Algeria	273	230	25	1	------
Belgian Congo [9]	89,156	[13] 112,456	[13] 136,992	[13] 138,949	[14] 120,000
French Congo	500	380	186	300	(7)
Morocco, French	------	------	75	------	(7)
Rhodesia:					
Northern	[9] 3,343	[9] 6,026	[9] 5,553	[9] 6,370	22,543
Southern [9]	------	110	362	1,334	538
South-West Africa [15]	10,700	11,300	12,600	15,100	19,300

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[1] In addition to the countries listed copper is produced in Asiatic Turkey, but data of output are not available.

[2] Copper content of ore, concentrates, and matte imported into the United States.

[3] Approximate production.

[4] Copper content of exports.

[5] Figures represent output of the more important districts only; that is, those reporting production of not less than 100 tons of fine copper.

[6] Content of sales and shipments.

[7] Data not available.

[8] Less than half a ton.

[9] Smelter product.

[10] Year ended Sept. 30.

[11] Small output from Russia in Asia included under Russia in Europe.

[12] Exports of ingots and slabs.

[13] Includes copper smelted in Belgium from mattes and alloys produced in the Belgian Congo as follows: 1928, 946 tons; 1929, 1,453, tons; 1930, 2,545 tons; 1931, data not available.

[14] Fine copper content of smelter output.

[15] Year ended Mar. 31 of year following that stated.

World mine production of copper, 1927–31, in metric tons—Continued

Country	1927	1928	1929	1930	1931
Africa—Continued					
Tunisia	12				
Union of South Africa	[9] 9, 324	[9] 8, 849	[9] 9, 309	8, 627	10, 206
	113, 308	139, 351	165, 102	170, 681	172, 587
Oceania:					
Australia	10, 133	9, 618	13, 018	13, 192	13, 749
New Caledonia				50	(7)
Papua [16]	117	1		(8)	
	10, 250	9, 619	13, 018	13, 242	13, 749
	1, 523, 000	1, 717, 000	1, 939, 000	1, 601, 000	(7)

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[7] Data not available.
[8] Less than half a ton.
[9] Smelter product.
[16] Copper content of exports for year ended June 30 of year stated.

BURDEN OF CURTAILMENT IN PRODUCTION

The present state of copper production largely reflects the abnormal state of consumption. It is therefore of interest to ascertain how the burden of production curtailment has been carried. For this purpose the average annual production of important groups of producers during the 5-year period 1925 to 1929 is compared in the following table with their corresponding productions in 1931.

The data reported by some of the companies are based on mine production, whereas those reported by others are based on smelter or refinery production. The totals for the companies given are therefore neither mine nor smelter totals but a combination of the two. The value of the table is not lessened because of these differences, however, as the figures for 1 period are comparable with those for the other, and changes in rates of production during the 2 periods are brought out clearly.

Production of copper by important groups, 1925–29 (average) and 1931, in short tons

Group	1925–29 (average)	1931	Increase or decrease (percent)
Anaconda (Butte, Chile Copper, Andes, Greene-Cananea, Walker, and Inspiration)	351, 921	270, 333	−23. 2
Kennecott (Alaska, Mother Lode, Nevada Consolidated, Utah Copper, Braden)	366, 208	251, 938	−31. 2
Phelps Dodge (Copper Queen, Morenci, Calumet and Arizona, Moctezuma)	171, 095	104, 064	−39. 2
Miscellaneous Arizona	143, 250	68, 892	−51. 9
Lake Superior	87, 292	59, 030	−32. 4
Miscellaneous large operations in the United States	23, 028	10, 828	−53. 0
Cerro de Pasco	45, 929	42, 000	−8. 6
Total production controlled in the United States accounted for	1, 188, 723	807, 085	−32. 1
Canada	83, 550	146, 152	+74. 9
Mexico (Boleo, Mazapil, Mexican Corporation)	18, 026	14, 486	−19. 6
Europe	151, 077	181, 881	+20. 4
Africa	138, 139	190, 244	+37. 7
Asia	92, 828	104, 400	+12. 5
Australia	12, 339	15, 156	+22. 8
Total production not controlled in the United States accounted for	495, 959	652, 319	+31. 5
Grand total production accounted for	1, 684, 682	1, 459, 404	−13. 4
Total world production	1, 805, 000	[1] 1, 536, 000	−14. 9
Percent of total world production accounted for	93. 3	95. 0	

[1] Estimated.

It appears from the foregoing table that copper production controlled in the United States has borne the chief burden of curtailment, whereas other production has largely increased. The former decreased 381,000 tons while the latter increased 156,000 tons. The largest percentage increase, that of Canada, is due to development of rich ores, some of them associated with considerable gold; the next largest, that of Africa, is due to new production from Northern Rhodesia. Both sources will remain important factors in future production.

WORLD CONSUMPTION

According to the American Bureau of Metal Statistics world consumption of copper in 1931 totaled 1,276,400 metric tons, a decrease of 18 percent from 1930 and 33 percent from 1929, the year of maximum consumption. It represents about the yearly average for 1923 and 1924, being 6 percent above consumption in 1923 but 6 percent below that in 1924. In 1931 North America consumed 44 percent of the total, Europe 49 percent, and Japan 5.5 percent; from 1926 to 1930 the respective percentages were 51, 43, and 4.5. The four principal consumers in 1931 and the proportion of the total each used were: United States 42.7 percent, Germany 12.5 percent, Great Britain 9.3 percent, and France 8.7 percent.

WORLD STOCKS

Complete data on the copper stocks of the world are not available, but the American Bureau of Metal Statistics publishes stocks for North and South America, Great Britain, Havre, and Japan. Total stocks in these countries at the close of 1931 were approximately 764,000 short tons, an increase of 27 percent for the year. It has been estimated that minimum stocks necessary to maintain the industry under normal conditions are approximately 300,000 tons, so that at the close of 1931 excess stocks totaled 464,000 tons compared with 303,000 tons at the beginning of the year, an increase of 53 percent.

COPPER TARIFF

Because the United States consumes nearly half of the copper produced by the world, domestic producers have tried to reserve this important market for themselves by obtaining a protective tariff. A tariff of 4 cents a pound was finally established by law and became effective June 21, 1932.

SUMMARY OF DOMESTIC STATISTICS

Summary of statistics of the copper industry in the United States, 1927–31

	1927	1928	1929	1930	1931
Production of copper:					
Smelter output from domestic ores pounds..	1,684,040,983	1,825,900,393	2,002,863,135	1,394,389,327	1,042,711,178
Mine production.............do....	1,649,959,370	1,809,796,907	1,995,110,398	1,410,147,374	1,057,749,350
Refinery production of new copper:					
Electrolytic.............pounds..	1,520,076,181	1,607,120,026	1,785,754,654	1,228,416,733	947,065,977
Lake....................do....	195,135,199	179,104,311	185,300,917	142,985,522	105,222,177
Casting..................do....	3,740,819	5,573,050	11,676,718	19,821,950	22,317,887
Total domestic.............do....	1,718,952,199	1,791,797,387	1,982,732,289	1,391,224,205	1,074,606,041
Total domestic and foreign pounds..	2,325,763,709	2,487,607,779	2,740,112,376	2,157,059,178	1,501,442,333
Total new and old copper....do....	3,306,000,000	3,560,000,000	3,993,000,000	3,091,000,000	2,195,000,000
Ore produced:					
Copper ore.............short tons..	56,725,460	62,097,132	[1] 68,421,853	[1] 47,381,509	[1] 34,048,510
Average yield of copper..per cent..	1.41	1.41	1.41	1.43	1.50
Copper-lead and copper-lead-zinc ores.................short tons..	418,601	351,131	259,126	246,430	213,245
Average price per pound.......cents..	13.1	14.4	17.6	13.0	9.1
Imports (unmanufactured)..pounds..	718,322,990	787,073,640	974,312,201	817,154,236	585,892,098
Exports of metallic copper [2]....do....	1,069,493,121	1,121,186,640	992,895,119	753,114,927	557,574,235
Withdrawn from total supply on domestic account:					
Total new copper..........pounds..	1,422,959,219	1,608,538,878	1,778,585,415	1,265,016,702	902,065,193
Total new and old copper....do....	2,403,000,000	2,681,000,000	3,032,000,000	2,199,000,000	1,596,000,000
Stocks at end of year:					
Refined copper...............do....	171,000,000	114,000,000	306,000,000	615,000,000	924,600,000
Blister and materials in solution pounds..	401,000,000	423,000,000	500,000,000	450,000,000	348,000,000
Value of smelter production from domestic ores........................	$220,609,000	$262,930,000	$352,504,000	$181,271,000	$94,887,000
World production (smelter).pounds..	3,346,616,000	3,761,085,000	4,197,600,000	3,474,484,000	3,004,900,000

[1] Includes old tailings, etc.

[2] Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined copper for which figures are not separable from those for ore and concentrates; also exclusive of "Other manufactures of copper" for which figures for quantity are not recorded.

PRODUCTION IN THE UNITED STATES

SOURCES OF PRODUCTION STATISTICS

Copper production usually occurs in three stages—mining, smelting, and refining—upon each of which an annual production record may be based. All three of these records are presented in this report to show the state of the industry from different viewpoints; however, smelter production has been adopted as the official production of this country because it is more complete and less subject to error, yet indicates geographical distribution with reasonable accuracy. The significance of each of the three methods of recording copper production is discussed at length in the 1930 chapter of this series.

SMELTER PRODUCTION

The copper output of United States smelters from domestic ores in 1931 was 1,042,711,178 pounds, 351,678,149 pounds (25 percent) less than the 1930 output. This production was 35 percent of world copper production, a marked decline from 50 percent in 1927, 48 percent in both 1928 and 1929, and 40 percent in 1930.

Copper produced in the United States from domestic ores, 1927–31

[Smelter output, in pounds fine]

State	1927	1928	1929	1930	1931
Alaska	56, 489, 214	40, 541, 968	39, 867, 940	36, 380, 038	23, 233, 034
Arizona	681, 168, 117	735, 632, 406	829, 206, 475	570, 897, 080	400, 310, 634
California	25, 802, 603	24, 707, 992	33, 084, 232	26, 262, 447	8, 344, 901
Colorado	8, 006, 801	10, 262, 083	10, 519, 784	12, 943, 857	9, 028, 517
Idaho	1, 811, 103	2, 336, 654	6, 267, 487	2, 713, 681	1, 626, 541
Michigan	195, 135, 199	179, 104, 311	185, 300, 917	142, 985, 522	105, 222, 177
Missouri	5, 041	930	1, 880	2, 198	----------
Montana	225, 208, 853	251, 046, 415	299, 894, 853	198, 795, 883	173, 910, 101
Nevada	118, 298, 342	159, 332, 977	138, 990, 247	87, 475, 019	71, 233, 352
New Mexico	79, 761, 222	92, 777, 233	100, 165, 206	74, 187, 966	66, 776, 267
North Carolina	5, 362, 041	8, 207, 000	(1)	(1)	(1)
Oregon	484, 652	375, 049	739, 151	229, 753	9, 332
Pennsylvania	2, 149, 182	5, 013, 868	3, 581, 393	3, 061, 174	843, 956
Tennessee	14, 498, 951	16, 374, 261	(1)	(1)	(1)
Texas	25, 460	432, 968	393, 740	165, 731	514
Utah	267, 705, 597	298, 375, 465	325, 965, 289	205, 769, 698	161, 023, 199
Vermont	238, 143	----------	752, 200	(1)	----------
Washington	1, 766, 953	1, 197, 340	1, 569, 260	1, 404, 893	71, 426
Wyoming	----------	2, 575	4, 305	29, 356	9, 545
Undistributed	123, 509	178, 898	26, 558, 776	31, 085, 031	21, 067, 682
	1, 684, 040, 983	1, 825, 900, 393	2, 002, 863, 135	1, 394, 389, 327	1, 042, 711, 178

(1) Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

Figures for smelter production in 1931 are based on confidential returns from all smelting companies handling copper-bearing materials from the United States. For Michigan the sum of furnace-refined copper and copper cast into anodes for electrolytic refining is included. Figures for blister copper represent the fine copper content. Some casting and electrolytic copper is produced direct from ore or matte, and this is included in smelter production. Metallic and cement copper recovered by leaching are also included in smelter production. Sincere thanks are extended to all companies and officials who have aided in furnishing this information and have given valuable time to answering inquiries concerning distribution of the output. A list of owning or operating companies, their location, and the final copper product of smelting and refining plants treating material from the United States during 1930 is shown on page 704 of the 1930 report of this series. There were only a few changes in this list during 1931. The Ajo and Douglas plants of the Calumet and Arizona Mining Co. were taken over by the Phelps Dodge Corporation and the Ajo plant was idle the entire year. The Humboldt plant of the Southwest Metals Co. was also idle during 1931.

The quantity and value of copper produced in the United States is shown by years from 1845 to 1930 in the chapter for 1930. These data may be summarized for comparison with 1931 as follows:

Copper produced (smelter output) in the United States, 1845–1931

Period	Thousands of pounds		Total value (thousands of dollars)
	Total	Yearly average	
1845–80	727, 992	20, 222	175, 490
1881–1900	5, 989, 529	299, 476	796, 355
1901–10	8, 563, 431	856, 343	1, 273, 911
1911–20	14, 321, 118	1, 432, 112	2, 850, 306
1921–30	14, 846, 807	1, 484, 681	2, 117, 235
1931	1, 042, 711	1, 042, 711	94, 887
	45, 491, 588	522, 892	7, 308, 184

MINE PRODUCTION

Figures of mine production are based on reports furnished to the Bureau of Mines by all mines producing copper. Details of the method of collecting the statistics and the reasons for the discrepancy between mine, smelter, and refinery production figures are given in the 1930 chapter. The following table compares mine, smelter, and refinery production during the past 5 years.

Copper produced from domestic ores, as reported by mines, smelters, and refineries, 1927–31, in pounds

Year	Mine	Smelter	Refinery
1927	1,649,959,370	1,684,040,983	1,718,952,199
1928	1,809,796,907	1,825,900,393	1,791,797,387
1929	1,995,110,398	2,002,863,135	1,982,732,289
1930	1,410,147,374	1,394,389,327	1,391,224,205
1931	1,057,749,350	1,042,711,178	1,074,606,041

PRODUCTION BY STATES AND DISTRICTS

The following tables show mine and smelter production by States for 1930 and 1931, smelter output by States from 1845 to 1931, and mine production by districts from 1927 to 1931. In 1931 Arizona, Montana, Utah, and Michigan led in production, with 81 percent of the smelter output; if the production of Nevada and New Mexico is added to the output of these States 94 percent of the output of the country is represented. Among the copper-producing districts Butte ranked first in 1931, Bingham second, Globe-Miami third, and Lake Superior fourth.

In total production from 1845 through 1931 Arizona, Montana, Michigan, and Utah were the principal producers, contributing 85 percent of the total output. Butte, Lake Superior, Bingham, and Bisbee were the principal districts.

Copper produced in the United States, 1930, 1931, and 1845–1931, according to smelter and mine returns, by States

[Thousands of pounds]

State	1930		1931			1845–1931	
	Smelter returns	Mine returns	Smelter returns		Mine returns	Smelter returns	
			Percent of total	Quantity		Percent of total	Quantity
Alaska	36,380	32,651	2.23	23,233	22,614	2.68	1,217,208
Arizona	570,897	576,191	38.39	400,311	401,345	32.72	14,886,178
California	26,262	27,285	.80	8,345	12,932	2.39	1,088,691
Colorado	12,944	10,514	.87	9,028	8,165	.79	361,325
Idaho	2,714	3,111	.16	1,627	1,145	.32	143,839
Michigan	142,985	169,381	10.09	105,222	118,059	18.66	8,487,504
Missouri	2	177	----------	----------	----------	(1)	(1)
Montana	198,796	196,188	16.68	173,910	184,556	22.81	10,377,145
Nevada	87,475	109,204	6.83	71,233	72,634	4.13	1,880,194
New Mexico	74,188	65,150	6.40	66,776	61,503	3.20	1,453,981
North Carolina	(2)	(2)	(2)	(2)	(2)	(1)	(1)
Oregon	230	176	----------	9	2	.05	20,618

[1] Included under "Undistributed." Figures not separately recorded.
[2] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

Copper produced in the United States, 1930, 1931, and 1845–1931, according to smelter and mine returns, by States—Continued

State	1930		1931			1845–1931	
	Smelter returns	Mine returns	Smelter returns		Mine returns	Smelter returns	
			Percent of total	Quantity		Percent of total	Quantity
Pennsylvania	3,061	2,860	0.08	844	(2)	(1)	(1)
Tennessee	(2)	(2)	(2)	(2)	(2)	[3] 1.14	[3] 519,017
Texas	166	143	--------	1	--------	(1)	(1)
Utah	205,770	180,526	15.44	161,023	151,236	10.37	4,716,098
Vermont	(2)	(2)	--------	--------	--------	(1)	(1)
Washington	1,405	1,206	.01	71	203	.06	28,413
Wyoming	29	12	--------	10	9	.07	31,719
Undistributed	31,085	35,372	2.02	21,068	23,346	[4] .61	[4] 279,658
	1,394,389	1,410,147	100.00	1,042,711	1,057,749	100.00	45,491,588

[1] Included under "Undistributed." Figures not separately recorded.
[2] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.
[3] Approximate production through 1928. Figures for 1929, 1930, and 1931 are confidential and included under "Undistributed."
[4] Includes also Tennessee for 1929, 1930, and 1931.

Mine production of copper in the principal districts,[1] 1927–31, in terms of recovered copper

[Thousands of pounds]

District or region	State	1927	1928	1929	1930	1931	
						Quantity	Percent of total production
Butte	Montana	221,312	247,067	296,316	195,472	184,362	17.43
Bingham	Utah	249,919	287,685	311,892	175,070	147,706	13.96
Globe-Miami	Arizona	171,167	160,430	191,596	158,120	126,444	11.95
Lake Superior	Michigan	177,538	178,443	186,402	169,381	118,059	11.16
Bisbee (Warren)	Arizona	138,595	161,492	186,130	127,900	95,328	9.01
Ely (Robinson)	Nevada	107,441	141,969	130,755	105,385	71,334	6.74
Central (including Santa Rita)	New Mexico	66,971	80,239	87,446	57,243	56,317	5.32
Yavapai County (mostly Jerome district).	Arizona	141,642	165,297	208,172	117,690	44,576	4.21
Pioneer	do	28,221	36,655	39,115	32,385	28,103	2.66
Ray (Mineral Creek)	do	62,860	68,661	66,287	36,118	24,438	2.31
Plumas County	California	21,055	21,141	24,929	19,529	12,454	1.18
Battle Mountain	Colorado	89	1,219	3,139	5,849	6,647	.63
Lordsburg	New Mexico	3,933	4,625	4,248	4,857	3,992	.38
Banner	Arizona	1,808	1,799	5,040	7,550	2,606	.25
Tintic	Utah	3,783	2,457	3,166	2,862	1,569	.15
Willow Creek	New Mexico	1,989	2,120	2,641	1,438	1,096	.10
Park City	Utah	2,595	2,639	2,524	1,678	819	.08
Shasta County	California	4,525	3,056	6,034	3,962	309	.03
Battle Mountain	Nevada	1,313	3,075	2,432	1,305	139	.01
Bonanza	Colorado	3,379	4,300	2,667	1,234	5	--------
Alder Creek	Idaho	685	516	2,824	1,122	--------	--------
Copper River [2]	Alaska	(3)	(3)	(3)	(3)	(3)	(3)
Prince William Sound [2]	do	(3)	(3)	(3)	(3)	(3)	(3)
Ajo [2]	Arizona	72,933	[4] 77,995	71,003	50,204	(3)	(3)
Morenci-Metcalf [2]	do	59,760	54,053	56,781	43,144	(3)	(3)
Silver Bell [2]	do	2,442	2,856	2,384	226	(3)	(3)
Jack Rabbit [2]	Nevada	1,392	2,026	2,638	1,995	(3)	(3)
Yerington [2]	do	9,504	10,988	3,270	(3)	(3)	(3)
Swain County [2]	North Carolina	5,443	8,207	(3)	(3)	(3)	(3)
Lebanon (Cornwall mine) [2]	Pennsylvania	1,736	4,978	3,454	2,860	(3)	(3)
Ducktown [2]	Tennessee	14,941	16,374	(3)	(3)	(3)	(3)

[1] Districts producing 2,000,000 pounds or more in any year of the period 1927–31.
[2] Not listed in order of output.
[3] Bureau of Mines not at liberty to publish figures.
[4] As shown in New Cornelia Copper Co. annual report to stockholders.

QUANTITY AND ESTIMATED RECOVERABLE CONTENT OF COPPER-BEARING ORES

The following tables show quantity and estimated recoverable copper content of ore produced by mines in the United States in 1930; the figures are taken from the mine reports in Mineral Resources. Detailed figures for 1931 were not available when this report was written. The close agreement between output as reported by smelters and recoverable content as reported by mines indicates that estimated recoverable tenor is very close to actual recovery. Classification of some of the complex western ores is difficult and more or less arbitrary. Under copper ores are classed not only those that contain 2.5 percent or more copper but also those that contain less than this percentage if they are valuable chiefly for copper. Under copper-lead and copper-lead-zinc ores are classed complex ores in which copper is a valuable constituent. Mines report considerable copper from ores mined primarily for other metals. These include siliceous gold and silver ores, lead ores, zinc ores, pyritic sulphur ores, and ores concentrated for their content of other metals.

Copper ore, old tailings, etc., sold or treated in the United States in 1930, with copper, gold, and silver content in terms of recovered metals

State	Ore, old tailings, etc., sold or treated (short tons)	Copper produced		Gold produced (fine ounces)	Silver produced (fine ounces)	Value of gold and silver per ton of ore, etc.
		Pounds	Percent			
Alaska	531,000	32,651,000	3.07	--------------	279,990	$0.20
Arizona	19,703,349	[1] 562,956,307	1.43	[1] 132,086.77	[1] 4,968,973	.24
California	[2] 857,786	[3] 27,007,276	1.57	23,473.31	670,398	.87
Colorado	63,915	5,953,000	4.66	4,675.33	1,484,589	10.45
Idaho	33,129	1,379,869	2.08	810.36	26,262	.81
Michigan	6,659,036	169,381,413	1.27	--------------	7,820	(4)
Montana	2,238,997	[5] 183,842,956	4.11	21,715.70	4,583,827	.99
Nevada	4,015,426	[6] 107,898,264	1.34	50,083.92	270,512	.28
New Mexico	2,636,107	61,048,300	1.16	17,138.87	228,494	.17
North Carolina	(7)	(7)	(7)	(7)	(7)	(7)
Oregon	1,033	175,427	8.49	112.00	1,050	2.63
Tennessee	[7] 915,358	[7] 35,372,356	[7] 1.93	[7] 1,218.47	[7] 117,748	[7] .08
Texas	734	44,200	3.01	--------------	411	.22
Utah	9,696,962	[8] 168,387,871	.87	80,953.27	944,113	.21
Vermont	(7)	(7)	(7)	--------------	(7)	(7)
Washington	28,565	1,204,218	2.11	100.43	27,592	.44
Wyoming	112	11,600	5.18	--------------	25	.09
Total and average [9]	47,381,509	1,357,314,057	1.43	332,368.43	13,611,804	.26

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[1] Excludes 12,700,073 pounds of copper but includes small quantity of gold and silver recovered from precipitates.

[2] Includes 51,157 tons of pyrites roasted for manufacture of sulphuric acid—residue leached—yielding 41 ounces of silver and 404,007 pounds of copper.

[3] Excludes 242,240 pounds of copper recovered from precipitates.

[4] Lump silver only produced in 1930.

[5] Excludes 11,465,232 pounds of copper recovered from precipitates.

[6] Excludes 8,847 pounds of copper recovered from "cyanide" precipitates.

[7] North Carolina and Vermont included with Tennessee.

[8] Excludes 1,141,251 pounds of copper recovered from mine-water precipitates and 2,048,369 pounds from ore leached in place.

[9] Exclusive of Pennsylvania where copper was produced from pyritiferous magnetite.

Copper ore, old tailings, etc., concentrated in the United States in 1930, with content in terms of recovered copper

State	Ore, old tailings, etc., concentrated (short tons)	Concentrates produced (short tons)	Copper produced (pounds)	Percent of copper from ore, etc.
Alaska	521, 604	42, 913	21, 242, 961	2. 04
Arizona	[1] 14, 683, 100	834, 907	301, 922, 928	1. 03
California	786, 362	51, 886	24, 124, 366	1. 53
Idaho	30, 971	2, 808	1, 209, 193	1. 95
Michigan	6, 659, 036	[2] 129, 003	[3] 169, 381, 413	1. 27
Montana	2, 145, 706	428, 954	176, 556, 845	4. 11
Nevada	3, 845, 476	192, 244	92, 502, 802	1. 20
New Mexico	2, 513, 560	91, 608	54, 375, 000	1. 08
Tennessee	[4] 520, 556	[4] 51, 955	[4] 11, 881, 125	[4] 1. 14
Utah	9, 592, 530	261, 035	162, 396, 675	. 85
Vermont	(4)	(4)	(4)	(4)
Washington	28, 336	1, 837	1, 136, 335	2. 01
Total and average [5]	41, 327, 237	2, 089, 150	1, 016, 729, 643	1. 23

[1] Includes 154,909 tons of slimes from a leaching plant.
[2] Includes concentrates from sands.
[3] Includes copper from sands.
[4] Vermont included with Tennessee.
[5] Exclusive of Pennsylvania where copper was produced from copper concentrates from pyritiferous magnetite.

Copper ore leached and smelted in the United States in 1930, with content in terms of recovered copper

State	Ore leached			Ore smelted		
	Short tons	Copper produced (pounds)	Percent of copper	Short tons	Copper produced (pounds)	Percent of copper
Alaska	---------	---------	---------	9, 396	11, 408, 039	60. 71
Arizona	[1] 3, 140, 566	65, 615, 576	1. 04	2, 032, 680	195, 166, 470	4. 80
California	[2] 33, 389	404, 007	. 61	19, 236	1, 718, 247	4. 47
Colorado	---------	---------	---------	63, 915	5, 953, 000	4. 65
Idaho	---------	---------	---------	2, 158	170, 676	3. 95
Montana	---------	---------	---------	63, 555	6, 203, 106	4. 88
Nevada	---------	---------	---------	169, 950	15, 395, 462	4. 53
New Mexico	---------	---------	---------	122, 547	6, 673, 300	2. 72
North Carolina	---------	---------	---------	(3)	(3)	(3)
Oregon	---------	---------	---------	1, 033	175, 427	8. 49
Tennessee	---------	---------	---------	[3] 394, 802	[3] 23, 491, 231	[3] 2. 98
Texas	---------	---------	---------	734	44, 200	3. 01
Utah	(4)	(4)	(4)	103, 565	5, 956, 696	2. 88
Washington	---------	---------	---------	229	67, 883	14. 82
Wyoming	---------	---------	---------	112	11, 600	5. 18
Total and average	3, 173, 955	66, 019, 583	1. 04	2, 983, 912	272, 435, 337	4. 57

[1] Also 154,909 tons of slimes from a leaching plant concentrated.
[2] Residue from pyrites roasted for manufacture of sulphuric acid.
[3] North Carolina included with Tennessee.
[4] Ore leached in place yielded 2,048,369 pounds of copper; quantity of ore unknown.

Copper-lead ore sold or treated in the United States in 1930, with content in terms of recovered copper [1]

State	Ore sold or treated (short tons)	Copper produced (pounds)	Percent of copper
Arizona	1, 309	85, 660	3. 27
Idaho	161, 863	491, 468	. 15
Montana	330	19, 000	2. 88
Nevada	30, 171	1, 225, 225	2. 03
Utah	52, 757	2, 204, 086	2. 09
Total and average	246, 430	4, 025, 439	. 82

[1] No copper-lead-zinc ore produced in 1930.

Ores, old tailings, etc., classed as copper-bearing (copper and copper-lead), sold or treated in the United States in 1930, with copper content, and copper produced from all sources, in terms of recovered copper

State	Copper from copper and copper-lead ores, old tailings, etc.			Copper from all sources, including old slags, smelter cleanings, and precipitates (pounds)
	Ores, old tailings, etc., sold or treated (short tons)	Copper produced (pounds)	Percent of copper	
Alaska	531,000	32,651,000	3.07	32,651,000
Arizona [1]	19,704,658	563,041,967	1.43	576,190,607
California	857,786	27,007,276	1.57	27,285,272
Colorado [2]	63,915	5,953,000	4.66	10,514,000
Idaho	194,992	1,871,337	.48	3,111,555
Michigan	6,659,036	169,381,413	1.27	169,381,413
Missouri	--------	--------	--------	176,600
Montana [1]	2,239,327	183,861,956	4.11	196,187,523
Nevada	4,045,597	109,123,489	1.35	109,203,512
New Mexico	2,636,107	61,048,300	1.16	65,150,000
North Carolina	(3)	(3)	(3)	(3)
Oregon	1,033	175,427	8.49	176,300
Pennsylvania [4]	--------	--------	--------	2,859,675
Tennessee	[3] 915,358	[3] 35,372,356	[3] 1.93	[3] 35,372,356
Texas	734	44,200	3.01	143,100
Utah [1]	9,749,719	170,591,957	.87	180,526,423
Vermont	(3)	(3)	(3)	(3)
Washington	28,565	1,204,218	2.11	1,206,438
Wyoming	112	11,600	5.18	11,600
Total and average	47,627,939	1,361,339,496	1.43	1,410,147,374

[1] Considerable copper was recovered from mine-water precipitates and ores not classed as copper ores.
[2] Much of the copper was derived in 1930 from ores classed as siliceous ores and lead-zinc ores.
[3] North Carolina and Vermont included with Tennessee.
[4] Copper recovered from pyritiferous magnetite.

Copper ores produced in the United States, 1926–30, and average yield in copper, gold, and silver

Year	Smelting ores		Concentrating ores		Total				
	Short tons	Yield in copper (percent)	Short tons	Yield in copper (percent)	Short tons	Yield in copper (percent)	Yield per ton in gold (ounce)	Yield per ton in silver (ounce)	Value per ton in gold and silver
1926	3,767,947	4.75	52,083,784	1.24	57,181,894	1.46	0.0064	0.293	$0.31
1927	3,407,610	4.67	49,179,035	1.23	56,725,460	1.41	.0065	.255	.28
1928	3,766,368	4.44	54,214,485	1.24	62,097,132	1.41	.0067	.236	.28
1929	4,235,192	4.60	[1] 59,727,536	1.22	[1] 68,421,853	1.41	.0067	.262	.28
1930	2,983,912	4.57	[1] 41,327,237	1.23	[1] 47,381,509	1.43	.0070	.287	.26

[1] Includes old tailings, etc.

REVIEW BY STATES AND COMPANIES

SCOPE OF DISCUSSION

This section summarizes briefly the operations of the principal copper-producing companies as reported in their annual reports or in the public press. In the 1930 chapter of this series tabulated data showing operations for several years were given. These cannot be repeated for 1931 owing to shortage of printing funds. Additional information, however, is given in the chapters on mine production by States.

The following table summarizes operations of the principal copper-mining companies during the past 3 years.

Summary of operations of the principal copper-mining companies of the United States, 1929–31

Company	Copper produced (short tons)			Approximate yield of copper (pounds per ton of ore treated)			Approximate cost[1] (cents per pound of copper)		
	1929	1930	1931	1929	1930	1931	1929	1930	1931
Anaconda (U.S. mines)	140, 969	92, 662	85, 622	(2)	(2)	(2)	(2)	(2)	(2)
Calumet and Arizona (including New Cornelia)	63, 570	43, 690	(3)	30	31	(2)	(2)	(2)	(2)
Calumet & Hecla and subsidiaries	67, 347	58, 200	40, 049	22	23	[4] 33	10. 2	10. 2	9. 9
Consolidated Coppermines	11, 366	16, 306	7, 538	21	29	24	(2)	10. 6	10. 2
Copper Range	12, 099	11, 897	8, 861	45	45	44	13. 2	11. 7	9. 8
Inspiration	53, 654	32, 803	30, 684	19	21	23	10. 3	9. 2	8. 0
Kennecott (Alaska mines)	14, 091	11, 495	6, 785	53	49	[5] 222	(2)	(2)	(2)
Magma	18, 258	15, 779	14, 380	135	125	124	8. 9	7. 6	7. 4
Miami	29, 421	33, 562	25, 286	12	11	11	11. 7	10. 9	9. 9
Mohawk	10, 022	6, 653	6, 550	32	28	30	7. 3	8. 7	7. 0
Mother Lode Coalition	6, 121	4, 823	4, 557	220	400	260	(2)	(2)	(2)
Nevada Consolidated	133, 137	70, 990	65, 478	21	18	21	8. 8	9. 5	8. 1
Phelps Dodge (U.S. mines)	88, 590	56, 479	[3] 90, 567	48	45	(2)	(2)	(2)	(2)
United Verde	71, 145	35, 360	9, 946	(2)	(2)	(2)	(2)	(2)	(2)
United Verde Extension	29, 534	20, 409	12, 295	166	136	129	8. 5	8. 5	7. 1
Utah Copper	148, 313	80, 569	71, 347	17	17	18	6. 2	7. 6	6. 6

[1] Exclusive of depletion, depreciation, and Federal taxes. The taxes proved to be inseparable in some cases but are a relatively small factor in cost per pound.

[2] Data not available.

[3] Calumet and Arizona included with Phelps Dodge for 1931.

[4] Tailings plant shut down in 1931.

[5] Low-grade Latouche mine shut down in 1931.

ALASKA

The Kennecott Copper Corporation operated the Kennecott mine throughout 1931; 55,530 tons of ore containing 12.01 percent copper and 2.27 ounces of silver per ton were mined, of which 53,051 tons averaging 9.59 percent copper were concentrated; the mill recovery of copper amounted to 92.44 percent. In 1930, 58,493 tons of ore containing 14.62 percent copper and 2.46 ounces of silver per ton were mined. The Latouche mine was idle all year. At the Mother Lode mine, controlled by Kennecott, 32,456 tons of ore averaging 13 percent copper and 2.06 ounces of silver per ton were mined compared with 27,486 tons averaging 20.31 percent copper and 3.24 ounces of silver per ton in 1930.

ARIZONA

Bisbee district.—The outstanding event of the year was the acquisition on October 1 of the assets and liabilities of the Calumet and Arizona Mining Co. by the Phelps Dodge Corporation. The transaction was effected by the exchange of 3.25 shares of Phelps Dodge stock for each share of Calumet and Arizona stock, for which Phelps Dodge capitalization was increased from 3,000,000 to 6,000,000 shares. It was stated that the merger had resulted in many economies and reductions in costs. Curtailment of production and necessity for rigid economy resulted in limiting production to the Junction and Campbell divisions in March 1932. Mining of milling ore in the Sacramento division was stopped in October 1931, and the Warren concentrator was closed in November. Natural gas was substituted for coal as fuel with considerable reduction in smelting and power costs. The Copper Queen smelter was closed in December, all smelting being confined to the smelter acquired from Calumet and Arizona. Production details for the Bisbee district were not published by the company, but the total output of copper for the district declined from 127,900,000 pounds in 1930 to 95,328,000 pounds in 1931.

The Shattuck Denn Mining Corporation did not produce any ore in 1931, operations being confined to development.

Globe-Miami district.—The Inspiration Consolidated Copper Co. treated 2,620,908 tons of ore yielding 61,368,033 pounds of copper in 1931 compared with 3,054,030 tons of ore yielding 65,606,664 pounds of copper in 1930. Ore mined amounted to 2,625,331 tons averaging 1.335 percent copper in 1931 and 3,041,854 tons averaging 1.224 percent in 1930. Metallurgical recoveries in 1931 were lower than in 1930 due largely to increased proportion of sulphide copper in ore treated at the leaching plant. Over 95 percent of the company copper production in 1931 was derived from leaching ores.

The Miami Copper Co. treated 4,438,808 tons of ore averaging 0.696 percent copper in 1931 compared with 6,124,993 tons averaging 0.716 percent in 1930. Production of refined copper decreased from 67,124,596 pounds in 1930 to 50,572,571 pounds in 1931. In spite of the lower grade of ore treated mill recoveries increased from 78.88 percent in 1930 to 84.40 percent in 1931 and the copper content of the concentrate from 34.13 to 40.88 percent, due largely to finer grinding. Milling costs per ton of ore were the lowest in the history of the property.

The Old Dominion Co. reduced its copper production from 17,596,795 pounds in 1930 to 11,347,711 pounds in 1931. The development program failed to disclose high-grade ore that could be worked with the price of copper under 10 cents a pound, so in November all operations were suspended. Pumping below the twelfth level was discontinued. According to the company's annual report for 1931 this decision precludes the possibility of again opening the lower levels on account of the great expense of unwatering that section of the mine.

The Iron Cap Copper Co. was idle throughout the year, and the Arizona Commercial Mining Co. (which sold its property to the Iron Cap Copper Co. in 1930) was dissolved in 1931. The Christmas mine, controlled by the Iron Cap Copper Co., produced 2,447,780 pounds of copper in 1931 compared with 6,924,735 pounds in 1930.

Morenci-Metcalf district.—The Morenci branch of the Phelps Dodge Corporation is the principal copper producer of this area. During 1931 mining operations were confined to the Humboldt mine area, and in spite of curtailed production operating costs were the lowest in the history of the property. Milling costs and extraction were also improved. The smelter operated on a part-time basis. Experimentation and testing of the Clay ore body were discontinued at the end of the year as its actual exploitation is indefinite under present market conditions. The company did not publish details of operations in 1931.

Yavapai County.—The United Verde Extension Mining Co. mined 183,151 tons of ore averaging 6.99 percent copper and 0.040 ounce of gold and 1.36 ounces of silver per ton compared with 301,562 tons averaging 6.65 percent copper, 0.038 ounce of gold, and 1.27 ounces of silver in 1930. Copper production from company ores decreased from 40,817,814 pounds in 1930 to 24,590,712 pounds in 1931. Operations were suspended from July 1 to November 1. Exploration in the Haynes ground disclosed favorable mineralization, and development was begun to explore this area on lower levels.

The United Verde Copper Co. shut down one furnace in April following a large rock slide which hindered mining operations in the open pit. In May, the entire smelter was closed, and operations for the rest of the year were confined to development and such extraction of ore as was required to maintain the mine in good condition. During the year the company purchased the Verde Central property. The company does not publish details of operations.

Ray or Mineral Creek district.—At the Ray mines of the Nevada Consolidated Copper Co. 1,286,600 tons of ore were treated in 1931 compared with 2,327,100 tons in 1930. Mining was confined to the No. 2 shaft area, which was operated on a day-shift basis only. The areas of low-grade ore, from which mine production has largely been supplied during the past few years, have been practically mined out, and better-grade blocks which will be mined next will result in lower production costs.

Ajo district.—The New Cornelia property operated throughout the year on a curtailed basis. During the past 2 years production capacity has been expanded by added concentration units, but owing to market conditions the full capacity of the plant has never been demonstrated. According to press reports about 7,000 tons of ore were handled daily during 1931 (estimated as 25 percent of full capacity). The electrolytic plant at Ajo was idle throughout the year. Details of operations in 1931 were not published by Phelps Dodge Corporation, the new owner of the property.

Pioneer district.—The Magma Copper Co. produced 231,862 tons of ore averaging 6.65 percent copper and 2.98 ounces of silver and 0.033 ounce of gold per ton. The smelter produced 28,839,617 pounds of copper, 771,316 ounces of silver, and 9,244 ounces of gold from company and custom ores. Mill heads averaged 6.16 percent copper, and the average mill recovery was 97.93 percent. Operations ceased about 3 months during the summer. Copper production in 1930 amounted to 31,884,271 pounds.

CALIFORNIA

The Engels Copper Mining Co. was idle throughout 1931, and early in 1932 it was reported in the press that the company had decided to liquidate.

The Walker Mining Co. milled 432,294 tons of ore from which 25,342 tons of concentrates were produced. Shipments of concentrates amounted to 25,532 tons containing 12,850,281 pounds of copper, 322,429 ounces of silver, and 13,614 ounces of gold. In 1930 shipments contained 15,776,171 pounds of copper. Early in December production was curtailed sharply and in March 1932 was discontinued. During 1931 an ore body considerably above the average in grade was discovered. The mine is reported to have ample reserves for future operations when the price of copper improves.

MICHIGAN

Lake Superior district.—The copper industry of the Lake Superior district has been affected severely by low prices in recent years. Mine production of the district in 1931 amounted to 118,059,491 pounds compared with 169,381,413 pounds in 1930 and 186,402,218 pounds in 1929.

The Calumet & Hecla Consolidated Copper Co. produced 72,367,000 pounds of refined copper in 1931, equivalent to 68 percent of the output in 1930 and 58 percent of that in 1929. The copper content of the conglomerate rock mined increased from 48.69 pounds per ton in 1930 to 51.48 pounds in 1931; that of the amygdaloid rock stamped increased from 17.86 to 18.31 pounds. The stamp mills treated 1,281,834 tons of amygdaloid rock and 783,829 tons of conglomerate rock. The smelter treated 55,000 tons of concentrates and mass from Calumet & Hecla mines and 100 tons of silver-bearing mineral from the Isle Royale mine. The tailings reclamation plants were idle all year. At the close of the year operations were further reduced to the basis of 5 day shifts per week.

The Isle Royale Copper Co. treated 353,075 tons of rock in 1931 compared with 510,262 tons in 1930. Production of refined copper decreased from 10,659,413 to 7,731,418 pounds, but recovery of refined copper per ton of rock treated increased from 20.89 to 21.90 pounds.

The Copper Range Co. treated in the Champion mill 404,830 tons of ore averaging 43.77 pounds of copper per ton. Copper production amounted to 17,721,270 pounds compared with 23,793,918 pounds in 1930; all the curtailment was at the Champion mine, the Baltic output being about the same as in 1930. At the close of the year the Baltic mine was shut down, and shortly afterwards further curtailment in production was made at the Champion mine. During the year the company obtained a controlling interest in C. G. Hussey & Co., of Pittsburgh, Pa., a copper-fabricating concern. The entire property of the Naumkeag Copper Co. and the assets of the St. Mary's Mineral Land Co. were also acquired.

The Mohawk Mining Co. continued operations throughout the year on the basis of the 2-shift day and 6-day week adopted in October 1930. Rock stamped in 1931 amounted to 443,940 tons, from which it is estimated that 13,100,000 pounds of copper will be recovered. In 1930 the copper production was estimated at 13,306,762 pounds. Exact production figures were not reported because large quantities of mineral were stored. In October, mill operations were reduced from a 6- to a 5-day operating basis. In the annual report for 1931 the president of the company stated that the directors were considering the desirability of liquidating the company's affairs owing to the uncertainty of the future of the copper industry and the short remaining life of the ore bodies.

The Quincy Mining Co. operated intermittently on a 5-day week basis up to the latter part of September 1931 when operations were suspended for an indefinite period. The smelter continued production from ore stocks until early in 1932. To provide funds for maintenance of the property, reorganization of the company was undertaken during the first half of 1932.

MONTANA

The Anaconda Copper Mining Co. is by far the most important producer in the Butte district. During 1931 the company (exclusive of its subsidiaries) produced from its own and custom copper ores 173,440,855 pounds of copper, 3,640,066 ounces of silver, and 19,486 ounces of gold compared with 197,233,145 pounds of copper, 5,569,147 ounces of silver, and 21,209 ounces of gold in 1930. Details of the company operations in the Butte district are not available.

During 1931 the surface plant of the Butte & Superior Mining Co. was dismantled, and the mine was allowed to fill with water following the cessation of production in 1930. The North Butte Copper Co. discontinued production in April 1931 and confined activities to development. The East Butte Copper Co. was dissolved during the year.

NEVADA

The Nevada Consolidated Copper Co. confined operations to the day shift at both underground and open-pit mines. No prospect drilling or development looking to extension of ore bodies was undertaken during the year. Two electric shovels were acquired and reduced costs so substantially that it has been decided to remodel or replace all steam shovels as circumstances permit. The concentrator treated 2,237,841 tons of company ore and 661,574 tons of custom ore in 1931 compared with 2,769,471 and 1,076,005 tons, respectively, in 1930. Improved milling operation was obtained by providing a secondary grinding circuit and additional classification. Smelting was confined to one reverberatory and one converter, and toward the end of the year these were operated only a part of each month. Copper production by the Nevada branch of the company was not stated.

The Consolidated Coppermines Corporation produced 15,075,605 pounds of copper, 8,141 ounces of gold, and 18,617 ounces of silver in 1931 compared with 32,612,203 pounds of copper, 13,918 ounces of gold, and 32,157 ounces of silver in 1930. Early in 1932 copper production had declined to 300,000 pounds a month. Ore production in 1931 amounted to 616,999 tons averaging 1.367 percent copper; it was treated by the Nevada Consolidated Copper Co.

NEW MEXICO

At the Chino branch of the Nevada Consolidated Copper Co. operations were on a part-time basis throughout the year. In all, 2,620,180 tons of ore were milled in 1931 compared with 2,513,560 tons in 1930. The Eighty-Five mine, acquired with Calumet and Arizona by Phelps Dodge in 1931, was closed at the end of the year. Subsequently all broken ore was removed from the stopes, all usable equipment was salvaged, and the pumps were pulled. The mine produced a siliceous copper-gold-silver ore which was used as a flux at the Douglas smelter. Cheaper flux is said to be available in the Bisbee district.

TENNESSEE

The principal copper producers of the Ducktown district do not publish details of their operations. In 1931 the Tennessee Copper Co. reported that operations had been drastically curtailed during the year. Ore reserves were increased from 6,034,148 tons at the beginning of the year to 6,075,622 tons at the close. The Ducktown Chemical & Iron Co. discontinued copper smelting during 1931 owing to the unsatisfactory market. Production of pyrite for the manufacture of acid and sinter was continued. The Fontana lease in North Carolina was terminated and all production confined to the Isabella mine, the Mary mine being allowed to flood.

UTAH

The Utah Copper Co. treated 8,147,764 tons of ore averaging 0.961 percent copper in 1931 compared with 9,552,500 tons averaging 0.973 percent in 1930. The average recovery of copper in the form of concentrates was 91.16 percent in 1931 and 89.00 percent in 1930. The net production of refined copper from all sources was 142,694,917 pounds in 1931, compared with 161,138,717 pounds in 1930 and 296,625,554 pounds in 1929. The Arthur concentrator was idle throughout the year. The copper content of the ore treated in 1931 was the lowest in the history of the property; nevertheless, extraction and grade of concentrate were the highest on record.

REFINERY PRODUCTION

The refinery output of copper in the United States in 1931 was made by 12 plants; 8 of these employed the electrolytic method, 3 the furnace process on Lake Superior copper, and 1 the furnace process on Arizona ore.

Five of the large electrolytic refineries are on the Atlantic seaboard, the 3 Lake refineries are on the Great Lakes, and 4 plants are west of the Great Lakes—1 each at Great Falls, Mont., Tacoma, Wash., El Paso, Tex., and Clifton, Ariz. In addition to these refineries are the electrolytic plants at Ajo and Inspiration, Ariz., which make electrolytically refined copper direct from the liquors obtained from leaching; this copper is shipped as cathodes to eastern refineries, where it is melted and cast into merchant shapes, and is accounted for in the production reported from these eastern refineries. The plant at Ajo was idle throughout 1931. There are also numerous plants in different parts of the country that make a considerable output from old copper and from brass and other copper alloys. The output of the regular refining plants is in the form of casting, Lake, and electrolytic copper.

Refinery production from ores of domestic and foreign origin is shown in the table on page 594. The domestic figure is the one that is to be compared with smelter production from domestic sources, the main difference being the time factor explained on page 701 of the 1930 report of this series; the figures for refinery production include copper that was mined some three months earlier than the beginning of the calendar year and smelted probably one or two months earlier.

Copper is marketed in various forms, such as casting and pig copper, Lake copper, and electrolytic copper. The differences in these various grades were explained on page 739 of the report for 1930. The following table gives the production of each grade during the past 5 years from domestic, foreign, and secondary sources.

Primary and secondary copper produced by regular refining plants in the United States and imported, 1927–31, in pounds

	1927	1928	1929	1930	1931
Primary:					
Domestic: [1]					
Electrolytic	1, 520, 076, 181	1, 607, 120, 026	1, 785, 754, 654	1, 228, 416, 733	947, 065, 977
Lake	195, 135, 199	179, 104, 311	185, 300, 917	142, 985, 522	105, 222, 177
Casting	3, 740, 819	5, 573, 050	11, 676, 718	19, 821, 950	22, 317, 887
	1, 718, 952, 199	1, 791, 797, 387	1, 982, 732, 289	1, 391, 224, 205	1, 074, 606, 041
Foreign: [1]					
Electrolytic	605, 748, 329	693, 787, 036	756, 555, 087	765, 189, 037	426, 307, 093
Casting and best select	1, 063, 181	2, 023, 356	825, 000	645, 936	529, 199
Refinery production of new copper	2, 325, 763, 709	2, 487, 607, 779	2, 740, 112, 376	2, 157, 059, 178	1, 501, 442, 333
Imports of refined copper	103, 279, 082	84, 730, 630	134, 014, 792	86, 210, 331	174, 449, 893
Total new refined copper made available	2, 429, 042, 791	2, 572, 338, 409	2, 874, 127, 168	2, 243, 269, 509	1, 675, 892, 226
Secondary:					
Electrolytic	168, 766, 566	191, 323, 029	331, 858, 103	279, 423, 370	156, 099, 339
Casting	41, 102, 000	41, 322, 776	2, 300, 000	1, 106, 114	28, 914
	209, 868, 566	232, 645, 805	334, 158, 103	280, 529, 484	156, 128, 253
Grand total	2, 638, 911, 357	2, 804, 984, 214	3, 208, 285, 271	2, 523, 798, 993	1, 832, 020, 479

[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation at this stage of manufacture is not possible.

SECONDARY COPPER

Under secondary copper is considered material recovered from remelting old copper, copper scraps, and copper recovered from the treatment of copper alloys or alloys that are treated without separation of the copper. A canvass of plants producing secondary copper has been made by J. P. Dunlop, of the Bureau of Mines, and the following figures are taken from his Mineral Resources chapter on Secondary Metals.

Secondary copper recovered in the United States in 1931 and imports and exports of scrap brass and copper, in short tons

Copper as metal	188, 300
Copper in alloys other than brass	72, 700
	261, 000
Copper from new scrap (not including brass)	45, 000
Copper from old scrap (not including brass)	216, 000
	261, 000
Brass scrap remelted:	
New clean scrap	58, 100
Old scrap	64, 700
	122, 800

Secondary copper recovered in the United States in 1931 and imports and exports of scrap brass and copper, in short tons—Continued

Copper content of brass scrap (averaging about 70 percent copper):	
New clean scrap	40, 700
Old scrap	45, 300
	86, 000
Total copper produced from secondary sources (including copper content of brass scrap):	
From new scrap	85, 700
From old scrap	261, 300
	347, 000
Imports of scrap brass	2, 212
Imports of scrap copper	2, 550
Exports of scrap brass	11, 592
Exports of scrap copper	33, 589

Refined copper from secondary sources produced in the United States, 1927–31, in pounds

1927	980, 400, 000	1930	934, 400, 000
1928	1, 072, 800, 000	1931	694, 000, 000
1929	1, 253, 100, 000		

COPPER SULPHATE

The production of hydrous copper sulphate or bluestone by copper refineries of the United States in 1931 was 35,265,409 pounds having a copper content of 8,983,000 pounds compared with 36,976,403 pounds having a copper content of 9,419,000 pounds in 1930.

STOCKS

Stocks of copper in the United States, January 1, 1928–32, in pounds

Year	Refined copper	Blister and materials in process of refining	Year	Refined copper	Blister and materials in process of refining
1928	171, 000, 000	401, 000, 000	1931	615, 000, 000	450, 000, 000
1929	114, 000, 000	423, 000, 000	1932	924, 600, 000	348, 000, 000
1930	306, 000, 000	500, 000, 000			

IMPORTS AND EXPORTS

Imports of unmanufactured copper into the United States in 1931 amounted to 585,892,098 pounds, a decrease of 28 percent from 1930 and 40 percent from the record imports of 1929. The principal sources and the percentage of the total contributed by each in 1931 were: Chile 29 percent, Canada 27 percent, Mexico 19 percent, Peru 15 percent, and Africa and Cuba each 4 percent. Imports from all these countries decreased materially in 1931. Chile decreased its shipments of ore and blister copper but increased those of refined copper. Canada likewise shipped less ore and blister copper but sent more concentrates and refined metal. A sharp decrease in imports of blister copper from Africa was offset partly by an increase in concentrate shipments. Blister copper is the principal copper import from Peru and Mexico. Imports of all classes of unmanufactured copper except concentrates and refined metal declined in 1931.

Copper (unmanufactured) imported into the United States in 1931, in pounds

[General imports]

Country	Ore (copper content)	Concentrates (copper content)	Regulus, black or coarse copper, and cement copper (copper content)	Unrefined black blister and converter copper in pigs or converter bars	Refined in ingots, plates, or bars	Old and scrap copper fit only for remanufacture, and scale and clippings	Composition metal, copper chief value
Africa:							
British—Union of South	124, 989	1, 152, 754		119, 590			
Mozambique	10, 970	18, 735, 667		2, 072, 034			
Australia			572, 126	4, 275, 476			
Canada	5, 890	33, 864, 502		39, 291, 472	83, 688, 691	4, 026, 929	
Chile	16, 687, 873	1, 793, 864	544, 487	61, 080, 468	90, 494, 303	29, 047	
Cuba	1, 217, 106	19, 778, 350				142, 887	
France	239, 211	19, 513	49, 116	5, 875			
Germany	904, 234	110, 555	56, 234	12, 140		91, 234	245
Mexico	881, 741	22, 184, 129		87, 158, 095		12, 568	
Peru	1, 157, 271	515, 247	34, 544	87, 381, 811	264, 659		
Spain	24, 300		144, 646				
United Kingdom	1, 796, 060		26, 685	2, 240	2, 240	32, 548	28
Venezuela	112, 294	1, 169, 990				91, 501	
Other	418, 207	83, 602	41, 500	451, 733		673, 629	32, 998
	23, 580, 146	99, 408, 173	1, 469, 338	281, 850, 934	174, 449, 893	5, 100, 343	33, 271
Total value	$1, 683, 438	$7, 146, 208	$112, 908	$24, 055, 221	$15, 348, 574	$277, 891	$2, 155

Copper (unmanufactured) imported into the United States, 1927–31, in pounds

[General imports]

1927	718, 322, 990
1928	787, 073, 640
1929	974, 312, 201
1930	817, 154, 236
1931	585, 892, 098

According to the Bureau of Foreign and Domestic Commerce 299,509 pounds of copper in "ore, concentrates, composition metal, and unrefined copper" were exported in 1931, as the following table shows. For several years copper producers have reported exportation of considerably more blister copper than the total shown by the Bureau of Foreign and Domestic Commerce under this classification, and in 1931 reported about 25 times as much blister as the total shown for ore, concentrates, etc. Apparently, in recent years, some blister copper has been classified incorrectly as refined copper.

In 1931, as in 1930, the United States exported more copper to the United Kingdom than to any other country; France stood second and Germany third. Exports (in millions of pounds) from the United States to the six leading importers of United States copper were as follows: In 1931, United Kingdom 124, France 120, Germany 97, Italy 44, Belgium 36, and Netherlands 32; in 1930, United Kingdom 176, France 148, Germany 110, Italy 81, Canada 44, and Netherlands 40.

Copper exported from the United States, 1930 and 1931, in pounds

Country	Ore, concentrates, composition metal, and unrefined copper (copper content)[1]	Refined[1]		Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Other copper manufactures
		Bars, ingots, or other forms	Rods						
1930									
Belgium		26, 364, 532	8, 106, 815	1, 075, 238		67, 211	251	90, 049	(2)
Canada	112, 377	13, 764, 603	21, 625, 069	1, 341, 203	1, 824, 655	2, 761, 757	464, 432	2, 263, 230	
China		5, 626, 532	4, 242	26, 660	94	8, 675	187, 620	276, 672	
Denmark		2, 099, 582	1, 008, 211		388	644	33, 432	19, 157	
France		141, 237, 293	1, 951, 292	4, 578, 216	1, 276	200, 336	44, 333	141, 445	
Germany		93, 860, 008		14, 288, 455	4, 561	829, 582	739, 712	4, 779	
India (British)		2, 680, 595	939, 375	576, 410	59	3, 019, 956	559, 302	180, 332	
Italy		78, 707, 287		106, 127		1, 827, 332	36, 228	23, 048	
Japan	1, 132	3, 187, 112	27, 314	1, 756, 257	1, 210	6, 384	15, 434	116, 977	
Netherlands	1, 976	27, 146, 308	5, 928, 285	5, 648, 314		583, 679	204, 269	42, 203	
Norway		1, 729, 632	2, 834, 119				3, 378	17, 054	
Soviet Russia in Europe		12, 695, 138					1, 963, 393	49, 226	
Spain		258, 487		2, 167, 672	13, 985		68, 072	154, 237	
Sweden		30, 673, 059				55, 920	15, 430	452, 115	
United Kingdom		142, 789, 077	27, 460, 545	2, 219, 607	7, 909	1, 027, 423	924, 449	1, 136, 061	
Other	63, 610	11, 295, 748	5, 252, 547	101, 481	843, 260	594, 470	10, 490, 690	15, 578, 704	
Total value	179, 095 $18, 569	594, 114, 993 $79, 691, 216	75, 137, 814 $10, 958, 235	33, 885, 640 $3, 744, 311	2, 697, 397 $673, 667	10, 983, 369 $1, 876, 248	15, 750, 425 $2, 714, 352	20, 545, 289 $4, 639, 577	(2) $1, 025, 875
1931									
Belgium		24, 389, 256	9, 876, 121	2, 118, 597	3, 577			28, 363	(2)
Canada	23, 299	7, 119, 358	7, 067, 663	816, 916	1, 677, 421	816, 223	157, 813	950, 188	
China		4, 723, 440			271	7, 639	206, 765	170, 407	
Denmark		2, 262, 902	1, 792, 728		131	2, 308	424, 836	21, 333	
France		109, 480, 532	2, 713, 999	7, 867, 026	1, 829	67, 691	7, 125	28, 670	
Germany	62, 237	58, 283, 390	482, 536	37, 910, 268	279		71, 179	5, 353	
India (British)		1, 673, 969	2, 223, 074	604, 683	71	1, 389, 962	159, 999	215, 269	
Italy		42, 902, 244	22, 943	381, 975		907, 998	3, 951	28, 482	
Japan	2, 009	188, 000	44, 811	2, 502, 472	1, 580	2, 319	2, 939	62, 880	
Netherlands		17, 845, 987	7, 386, 440	6, 672, 853	1, 241	347, 279	194	38, 904	
Norway		465, 788	1, 633, 380	22, 305	85		1, 718	16, 029	
Soviet Russia in Europe		7, 744, 019		1, 255, 762	5, 095			10, 403	
Spain		112, 030		1, 429, 652	10, 148	1, 701	2, 590	37, 495	
Sweden		28, 859, 373		56, 934	134	155	404	3, 445	
United Kingdom	209, 016	94, 249, 265	21, 857, 777	5, 452, 948	10, 094	589, 102	348, 224	1, 090, 212	
Other	2, 948	5, 096, 579	3, 729, 429	84, 621	358, 863	404, 856	4, 880, 481	10, 586, 487	
Total value	299, 509 $24, 265	405, 396, 132 $38, 098, 529	58, 830, 901 $6, 178, 277	67, 177, 012 $5, 497, 814	2, 070, 819 $414, 769	4, 537, 233 $644, 772	6, 268, 218 $804, 592	13, 293, 920 $2, 567, 974	(2) $516, 818

[1] See text on preceding page.

[2] Figures for quantity not recorded.

Copper exported from the United States, 1927–31 [1]

Year	Pounds		Total value	Year	Pounds		Total value
	Metallic [2]	Total			Metallic [2]	Total	
1927	1,069,493,121	1,076,729,246	$149,114,730	1930	753,114,927	753,294,022	$104,316,175
1928	1,121,186,640	1,125,019,417	168,525,383	1931	557,574,235	557,873,744	54,230,992
1929	992,895,119	998,474,549	181,684,409				

[1] Exclusive of "Other manufactures of copper," valued at $1,098,886 in 1927, $1,296,996 in 1928, $1,720,363 in 1929, $1,025,875 in 1930, and $516,818 in 1931; quantity not recorded.
[2] Exclusive of ore, concentrates, composition metal, and unrefined copper.

Copper sulphate (blue vitriol) exported from the United States, 1927–31

Year	Pounds	Value	Year	Pounds	Value
1927	6,206,904	$320,653	1930	5,061,554	$252,614
1928	8,666,899	455,023	1931	7,190,919	276,575
1929	6,419,688	368,481			

Brass and bronze exported from the United States, 1930 and 1931

	1930		1931	
	Pounds	Value	Pounds	Value
Ingots	2,007,597	$266,050	1,169,168	$105,482
Scrap and old	45,226,200	4,157,101	23,183,812	1,519,386
Bars and rods	3,151,342	620,858	2,079,981	287,073
Plates and sheets	1,416,513	343,650	646,853	132,615
Pipes and tubes	4,634,490	1,058,923	3,189,405	557,350
Pipe fittings and valves	3,200,872	1,850,080	1,858,827	1,014,224
Plumber's brass goods	984,090	574,608	706,060	376,309
Wire of brass or bronze	1,341,546	427,559	1,235,093	314,832
Brass wood screws	(1)	125,827	(1)	65,703
Hinges and butts of brass or bronze	(1)	93,106	(1)	37,797
Other hardware of brass or bronze	(1)	588,200	(1)	336,596
Other brass and bronze manufactures	(1)	2,890,425	(1)	1,545,875
	------------	12,996,387	------------	6,293,242

(1) Weight not recorded.

Unmanufactured brass exported from the United States, 1927–31

[Ingots,[1] bars, rods, plates, and sheets]

Year	Pounds	Value	Year	Pounds	Value
1927 [1]	3,511,299	$648,853	1930	6,575,452	$1,230,558
1928 [1]	4,403,726	905,430	1931	3,896,002	525,170
1929	7,627,717	1,597,758			

[1] Exclusive of ingots in 1927 and 1928, figures for which are not separable from those for "scrap and old."

CONSUMPTION

As calculated by the method shown in the following table the quantity of new copper consumed in a year is actually the amount of new copper withdrawn from available supply on domestic account. This method of computation is not accurate, as figures on consumers' stocks are not available and cannot be taken into account. In addition, much copper withdrawn on domestic account is later exported in manufactured forms. The domestic withdrawals in 1931 totaled 902,065,193 pounds, a decrease of 29 percent from 1930 and 49 percent from the record year 1929.

New refined copper withdrawn from total year's supply on domestic account, 1928–31, in pounds

	1928	1929	1930	1931
Total supply of new copper	2,572,338,409	2,874,127,168	2,243,269,509	1,675,892,226
Stock at beginning of year	171,000,000	114,000,000	306,000,000	615,000,000
Total available supply	2,743,338,409	2,988,127,168	2,549,269,509	2,290,892,226
Copper exported[1]	1,020,799,531	903,541,753	669,252,807	464,227,033
Stock at end of year	114,000,000	306,000,000	615,000,000	924,600,000
	1,134,799,531	1,209,541,753	1,284,252,807	1,388,827,033
Withdrawn on domestic account	1,608,538,878	1,778,585,415	1,265,016,702	902,065,193

[1] Includes refined copper in ingots, bars, rods, or other forms.

Adding the 694,000,000 pounds of secondary copper and copper in alloys produced during the year to the 902,000,000 pounds of new refined copper withdrawn on domestic account gives a total of 1,596,000,000 pounds of new and old copper available for domestic consumption in 1931.

USES

The American Bureau of Metal Statistics estimates the quantity of primary and secondary copper consumed each year by various uses. The following table is taken from the 1931 yearbook of that bureau.

Estimated use of copper in the United States, 1927–31, in short tons[1]

Purpose	1927	1928	1929	1930	1931
Electrical manufactures[2]	196,500	213,000	261,000	221,000	162,000
Telephones and telegraphs	93,000	119,000	164,000	122,000	70,000
Light and power lines[3]	103,000	115,000	127,000	130,000	85,000
Wire cloth	5,400	7,100	9,000	9,200	4,900
Other wire	76,050	87,100	106,200	93,700	55,000
Ammunition	4,600	8,200	6,900	5,100	5,000
Automobiles[4]	100,800	127,400	138,200	87,000	61,600
Buildings	52,800	62,000	59,000	50,000	45,000
Castings, n.e.s.[5]	67,200	72,500	79,500	55,400	36,000
Clocks and watches	5,000	4,600	4,300	2,600	2,000
Coinage	850	800	1,200	850	100
Copper-bearing steel	1,600	1,600	2,600	1,900	1,200
Fire-fighting apparatus	2,500	2,300	2,400	1,700	1,300
Radiators, heating	850	1,100	2,100	3,000	1,700
Radio receiving sets	4,500	8,400	15,500	13,000	10,000
Railway equipment	8,000	6,000	9,600	8,600	1,300
Refrigerators	15,800	13,800	17,200	15,000	13,000
Shipbuilding	6,000	1,600	2,400	5,000	3,200
Washing machines	3,800	4,200	4,500	1,200	1,600
Water heaters, household	3,000	2,600	2,300	1,800	1,400
Other uses	53,800	65,800	70,000	57,000	40,500
Manufactures for export	57,400	66,600	74,900	71,100	48,200
Total	862,450	990,700	1,159,800	956,150	650,000

[1] Year Book, American Bureau of Metal Statistics, 1931, p. 34.
[2] Generators, motors, electric locomotives, switchboards, light bulbs, etc.
[3] Transmission and distribution wire and bus bars.
[4] Does not include starter, generator, and ignition equipment.
[5] Bearings, bushings, lubricators, valves, and fittings.

The following table shows the copper cast in different forms in 1930 and 1931. It will be noted that the totals are not the same as for the production of refined copper.

Copper cast in different forms in the United States, 1930 and 1931

Form	1930		1931	
	Pounds	Percent	Pounds	Percent
Wire bars	1,711,000,000	70.18	1,094,000,000	66.06
Cakes	267,000,000	10.95	189,000,000	11.41
Cathodes	176,000,000	7.22	162,000,000	9.78
Ingots	177,000,000	7.26	119,000,000	7.19
Other forms	107,000,000	4.39	92,000,000	5.56
	2,438,000,000	100.00	1,656,000,000	100.00

PRICES

Reports to the Bureau of Mines from copper-selling agencies in the United States indicate that 1,836,993,000 pounds of copper were delivered to domestic and foreign purchasers in 1931 at an average price of 9.1 cents per pound (3.9 cents less than in 1930 and 8.5 cents less than in 1929). The average price of the entire production for the 87 years from 1845 to 1931, inclusive, is 16.1 cents a pound and for the 30 years from 1902 to 1931 is 16.3 cents.

The following table shows monthly quotations for copper during the past 5 years, as reported by the American Metal Market Co. and the Engineering and Mining Journal. The 1931 averages are the lowest on record.

Average monthly prices at New York per pound of electrolytic copper, 1927–31, in cents, as reported by the American Metal Market Co. and Engineering and Mining Journal

Month	American Metal Market Co.[1]					Engineering and Mining Journal				
	1927	1928	1929	1930	1931	1927	1928	1929	1930	1931
January	13.12	13.96	16.72	17.87	9.90	12.990	13.854	16.603	17.775	9.838
February	12.80	13.97	17.92	17.87	9.83	12.682	13.823	17.727	17.775	9.724
March	13.21	13.98	21.26	17.87	10.02	13.079	13.845	21.257	17.775	9.854
April	12.93	14.10	19.80	15.74	9.57	12.808	13.986	19.500	15.621	9.392
May	12.74	14.31	17.87	12.83	8.81	12.621	14.203	17.775	12.756	8.665
June	12.46	14.62	17.87	12.24	8.18	12.370	14.527	17.775	12.049	8.025
July	12.63	14.62	17.87	11.15	7.80	12.532	14.527	17.775	11.023	7.698
August	13.11	14.62	17.87	10.79	7.40	12.971	14.526	17.775	10.693	7.292
September	13.05	14.83	17.91	10.45	7.13	12.940	14.724	17.775	10.310	6.988
October	13.12	15.31	17.87	9.70	6.89	12.958	15.202	17.775	9.597	6.775
November	13.45	15.90	17.87	10.25	6.67	13.319	15.778	17.775	10.113	6.558
December	13.95	15.94	17.87	10.49	6.72	13.774	15.844	17.775	10.300	6.580
Average	13.05	14.68	18.23	13.11	8.24	12.920	14.570	18.107	12.982	8.116

[1] F.o.b. refinery through August 1927; thereafter, averages represent New York refinery equivalent.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEVADA[1]

(MINE REPORT)

By V. C. Heikes[2]

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SUMMARY

The output of gold, silver, copper, lead, and zinc from Nevada mines in 1931 was valued at $11,673,787, a decrease of $9,781,730 compared with 1930; the number of producers reporting was 336, an increase of 56. Production of all metals, particularly copper and silver, decreased as a result of decline in metal prices and decided curtailment of production at all base-metal properties.

In 1931 White Pine County again led in value of metals recorded and yielded nearly 63 percent (69 percent in 1930) of the total value of metals produced in the State, due to its large output of copper. Nye County, with the largest output of lead, was second in total value of metals produced. Lincoln County, with the largest output of zinc and the second largest of lead, ranked third; its total value fell below $1,000,000 for the first time since 1927. Elko County, with its chief values in gold and silver, ranked fourth; its total value decreased from $666,773 in 1930 to $636,691 in 1931.

The total value of the mine production of gold, silver, copper, lead, and zinc in Nevada from 1904 to 1931, inclusive, as recorded in Mineral Resources, was $750,992,567. Details of production follow: Ore, old tailings, etc., 110,294,053 short tons; gold, $215,234,386; silver, 252,778,753 fine ounces ($169,955,647); copper, 1,920,421,575 pounds ($316,230,982); lead, 413,321,461 pounds ($25,683,509); and zinc, 306,002,540 pounds ($23,888,043).

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

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[1] Work on manuscript completed October 1932.

[2] H. M. Gaylord, assisted by B. N. Lowry, both of the Bureau of Mines, prepared the statistics for this report.

Prices of silver, copper, lead, and zinc, 1927–31

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064	1930	$0.385	$0.130	$0.050	$0.048
1928	.585	.144	.058	.061	1931	.290	.091	.037	.038
1929	.533	.176	.063	.066					

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1927–31, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1927	379	30	5,531,152	150,346.16	$3,107,931	5,397,179	$3,060,200
1928	330	29	7,057,433	175,157.79	3,620,833	5,481,574	3,206,721
1929	323	15	7,355,500	163,711.22	3,384,211	4,923,526	2,624,239
1930	247	33	4,757,178	149,064.47	3,081,436	4,219,832	1,624,635
1931	271	65	3,565,472	142,293.76	2,941,473	2,562,071	743,001

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1927	120,259,276	$15,753,965	15,784,818	$994,444	6,344,523	$406,049	$23,322,589
1928	158,876,883	22,878,271	15,747,444	913,352	6,796,713	414,599	31,033,776
1929	140,138,809	24,664,430	19,692,568	1,240,632	16,920,083	1,116,725	33,030,237
1930	109,203,512	14,196,457	23,058,381	1,152,919	29,168,117	1,400,070	21,455,517
1931	72,634,497	6,609,739	15,860,634	586,843	20,861,348	792,731	11,673,787

Gold and silver produced at placer mines in Nevada, 1927–31

Year	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
1927	1,809.22	$37,400	740	$419
1928	1,851.12	38,266	839	491
1929	2,117.00	43,762	1,025	546
1930	1,859.44	38,438	847	326
1931	2,883.25	59,602	860	249

GOLD

Mine production of gold in Nevada decreased from $3,081,436 in 1930 to $2,941,473 in 1931. In 1931, as from 1927 to 1930, the Nevada Consolidated Copper Co. was the largest producer of gold in Nevada. The leading gold-producing counties were White Pine, Nye, Elko, and Esmeralda; and they produced 81 percent of the total gold yield of the State. The output of White Pine and Esmeralda decreased, but that of Nye and Elko increased from 1930. Substantial increases in gold production were reported by the Gold Hill Development Co., Ely Gold Mining Co., Tonopah Mining Co., and Nevada Porphyry Gold Mines, Inc.; decreases were reported by the Nevada Consolidated Copper Co., Consolidated Coppermines Corporation, and Seven Troughs Gold Mines Co. Ore was treated by amalgamation in 14 counties and ore and old tailings by cyanidation in 10 counties in 1931; by these two methods $1,751,414 in gold was recovered from 174,470 tons of ore and 275,950 tons of old tailings. Concentrates yielded $783,098 in gold and crude ore shipped to smelters $346,878. The chief gold-producing districts in 1931 were the Robinson in White Pine County, Jarbidge in Elko County, Round Mountain in Nye County, Goldfield in Esmeralda County, Tonopah in Nye and Esmeralda Counties, and Seven Troughs in Pershing County, each producing between 5,000 and 40,000 ounces. Placer gold in 1931 was valued at $59,602 ($21,164 more than in 1930) and came chiefly from Nye, Lander, Eureka, Pershing, and White Pine Counties.

Four companies—Nevada Consolidated Copper Co., Elkoro Mines Co., Gold Hill Development Co., and Bradshaw, Inc., leasing the Goldfield Consolidated tailings dump—produced slightly over 50 percent of the total gold yield of Nevada in 1931; 10 other companies, each producing between 2,000 and 10,000 ounces, yielded 30 percent of the total.

SILVER

Mine production of silver in Nevada decreased from 4,219,832 fine ounces in 1930 to 2,562,071 ounces in 1931, and the total value from $1,624,635 to $743,001; the average price per ounce decreased from 38.5 to 29 cents. Nye County led in yield of silver, with a production of over 1,350,000 ounces. Large decreases were recorded in Elko, Esmeralda, Eureka, Lander, Lincoln, Lyon, Pershing, and White Pine Counties. The chief silver-producing districts were Tonopah in Esmeralda and Nye Counties, Tybo in Nye County, Pioche in Lincoln County, Jarbidge in Elko County, Jack Rabbit in Lincoln County, and Robinson in White Pine County. In Nye County bullion recovered at amalgamation and cyanidation mills contained 639,106 ounces of silver (nearly 25 percent of the total yield of the State); most of it (635,285 ounces) was recovered by cyanidation. Concentrates recovered from ore and old tailings produced in Nevada yielded 1,043,719 ounces of silver, of which flotation concentrates contained 1,041,683 ounces. Lead concentrates yielded 780,266 ounces of silver, an average recovery of 67.21 ounces a ton, compared with 948,794 ounces, an average of 61.28 ounces, in 1930.

Seven properties, each producing more than 100,000 ounces, yielded over 82 percent of the total silver from Nevada mines in 1931. These properties were the Treadwell Yukon at Tybo, the Tonopah Mining at Tonopah, the Combined Metals near Pioche, the Elkoro at Jarbidge, the Belmont at Tonopah, the Bristol Silver near Pioche, and the Tonopah Extension at Tonopah. In 1930 the Tonopah Extension ranked first among nine producing more than 100,000 ounces.

COPPER

Mine production of copper in Nevada was 72,634,497 pounds in 1931, a decrease of 36,569,015 pounds (over 33 percent) from 1930; the total value decreased $7,586,718 (over 53 percent). Concentrates yielded nearly 95 percent of the total copper, and crude ore shipped to smelters yielded slightly more than 5 percent. Flotation concentrates yielded 68,882,045 pounds and table concentrates 2,031 pounds.

The Nevada Consolidated Copper Co., operating its mine, mill, and smelter at Ely and McGill, was the largest producer of copper in the State. This property with three others—the Consolidated Coppermines at Kimberly, the Bristol Silver near Pioche, and the Copper Canyon property near Battle Mountain—yielded 99.57 percent of the total copper from Nevada in 1931.

LEAD

Mine production of lead in Nevada was 15,860,634 pounds in 1931, a decrease of 7,197,747 pounds from 1930. Concentrates recovered from the milling of ore and old tailings yielded 14,209,388 pounds of lead, all by flotation. Crude ore of shipping grade yielded 1,651,246 pounds compared with 5,990,437 pounds in 1930. Nearly 91 percent of the lead in 1931 came from lead-zinc ore and nearly 6 percent from lead ore and old tailings.

Five mines—the Treadwell Yukon property in Nye County, Combined Metals and Bristol Silver in Lincoln County, and Duplex and Yellow Pine in Clark County—yielded over 94 percent of the total lead from Nevada in 1931.

ZINC

Mine production of zinc in Nevada was 20,861,348 pounds in 1931, a decrease of 8,306,769 pounds from 1930. The Pioche district in Lincoln County produced over 64 percent of the total zinc output of the State, followed by the Tybo district in Nye County and the Yellow Pine district in Clark County.

The Combined Metals mine near Pioche in Lincoln County, the Treadwell Yukon mine in Nye County, and five properties in the Yellow Pine district in Clark County yielded all the zinc.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1931, by counties, in terms of recovered metals

County	Gold					Silver (lode and placer)	
	Lode		Placer		Total value	Fine ounces	Value
	Fine ounces	Value	Fine ounces	Value			
Churchill	245.45	$5,074	-----	-----	$5,074	13,396	$3,885
Clark	5,659.39	116,990	-----	-----	116,990	12,662	3,672
Douglas	54.37	1,124	-----	-----	1,124	92	27
Elko	26,435.00	546,460	2.95	$61	546,521	258,918	75,086
Esmeralda	17,915.93	370,355	19.83	410	370,765	216,548	62,799
Eureka	728.34	15,056	257.16	5,316	20,372	5,685	1,649
Humboldt	699.79	14,466	16.69	345	14,811	1,023	297
Lander	3,379.58	69,862	899.29	18,590	88,452	4,258	1,235
Lincoln	908.64	18,783	-----	-----	18,783	467,218	135,493
Lyon	1,302.64	26,928	3.82	79	27,007	1,156	335
Mineral	1,615.38	33,393	18.29	378	33,771	2,429	704
Nye	31,746.34	656,255	1,257.31	25,991	682,246	1,352,509	392,228
Pershing	6,398.56	132,270	184.41	3,812	136,082	14,113	4,093
Storey	4,274.32	88,358	-----	-----	88,358	26,074	7,561
Washoe	388.59	8,033	52.54	1,086	9,119	1,148	333
White Pine	37,658.19	778,464	170.96	3,534	781,998	184,842	53,604
	139,410.51	2,881,871	2,883.25	59,602	2,941,473	2,562,071	743,001
Total, 1930	147,205.03	3,042,998	1,859.44	38,438	3,081,436	4,219,832	1,624,635

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1931, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill			200	$7			$8,966
Clark	8,887	$809	796,107	29,456	1,899,328	$72,174	223,101
Douglas							1,151
Elko	51,000	4,641	282,235	10,443			636,691
Esmeralda	10,537	959	58,719	2,173			436,696
Eureka	2,565	233	126,010	4,662			26,916
Humboldt	8,105	738					15,846
Lander	142,437	12,962	5,972	221			102,870
Lincoln	973,863	88,622	6,329,860	234,205	13,416,759	509,837	986,940
Lyon	57,510	5,233					32,575
Mineral							34,475
Nye	25,396	2,311	8,165,518	302,124	5,545,261	210,720	1,589,629
Pershing	2,220	202	11,520	426			140,803
Storey	1,390	126	6,619	245			96,290
Washoe							9,452
White Pine	71,350,587	6,492,903	77,874	2,881			7,331,386
	72,634,497	6,609,739	15,860,634	586,843	20,861,348	792,731	11,673,787
Total, 1930	109,203,512	14,196,457	23.058,381	1,152,919	29,168,117	1,400,070	21,455,517

MINING INDUSTRY

Conditions in the mining industry in Nevada in 1931 were much worse than in 1930. Production at the copper mines at Ely at the beginning of 1931 was below 40 percent of their proved capacity and at the end of the year was below 30 percent of such capacity. Lead producers of the State, of which the Tybo property of the Treadwell Yukon Co., Ltd., was the largest, curtailed operations; the company reduced its output 50 percent early in the year, and discontinued milling operations in October. The third largest lead and copper producer in the State, the Bristol Silver Mines Co. near Pioche, closed its property in June. The Combined Metals Reduction Co. limited its output of lead-zinc ore considerably. The State metal production decreased by more than 36,500,000 pounds of copper, 1,600,000 ounces of silver, 7,190,000 pounds of lead, 8,300,000 pounds of zinc, and $139,963 in gold. The decrease in gold was due largely to curtailment in output of copper ores at Ely and silver ores in the Tonopah district; this loss was partly offset by decided increase in gold production at Round Mountain. Gold output from the Goldfield tailing dump was slightly less than in 1930.

ORE CLASSIFICATION

Ore and old tailings sold or treated in Nevada in 1931, with content in terms of recovered metals

Source	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	[1] 462,887	90,131.53	420,523	55,936	15,946	----------
Dry gold and silver ore	18,381	10,079.20	853,474	3,593	----------	----------
Dry silver ore	[2] 1,889	155.36	49,158	----------	----------	----------
Copper ore	2,936,899	33,807.07	225,355	[3] 72,332,205	----------	----------
Lead ore	[4] 22,297	3,594.24	29,515	11,106	932,552	----------
Zinc ore	75	----------	----------	----------	10,788	41,004
Copper-lead ore	3,824	53.74	53,136	139,373	480,622	----------
Lead-zinc ore	119,220	1,589.37	930,050	92,284	14,420,726	20,820,344
Total, lode mines	3,565,472	139,410.51	2,561,211	[3] 72,634,497	15,860,634	20,861,348
Total, placers	----------	2,883.25	860	----------	----------	----------
	3,565,472	142,293.76	2,562,071	[3] 72,634,497	15,860,634	20,861,348
Total, 1930	[5] 4,757,178	149,064.47	4,219,832	[6] 109,203,512	23,058,381	29,168,117

[1] Includes 274,550 tons of old tailings cyanided and 26 tons of old tailings smelted.
[2] Includes 1,400 tons of old tailings cyanided.
[3] Includes 9,358 pounds of copper recovered from "cyanide" precipitates.
[4] Includes 10,110 tons of old tailings concentrated.
[5] Includes small quantity of old mill cleanings.
[6] Includes 8,847 pounds of copper recovered from "cyanide" precipitates.

Value of metals from ore and old tailings sold or treated in Nevada in 1931, by classes of ore

Class	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons						
Dry gold ore	462,887	$1,863,184	$121,952	$5,090	$590	----------	$1,990,816
Dry gold and silver ore	18,381	208,356	247,508	327	----------	----------	456,191
Dry silver ore	1,889	3,212	14,256	----------	----------	----------	17,468
Copper ore	2,936,899	698,854	65,353	[1] 6,582,230	----------	----------	7,346,437
Lead ore	22,297	74,299	8,559	1,011	34,504	----------	118,373
Zinc ore	75	----------	----------	----------	399	$1,558	1,957
Copper-lead ore	3,824	1,111	15,409	12,683	17,783	----------	46,986
Lead-zinc ore	119,220	32,855	269,715	8,398	533,567	791,173	1,635,708
	3,565,472	2,881,871	742,752	[1] 6,609,739	586,843	792,731	11,613,936
Total, 1930	[2] 4,757,178	3,042,998	1,624,309	[3] 14,196,457	1,152,919	1,400,070	21,416,753

[1] Includes value of 9,358 pounds of copper recovered from "cyanide" precipitates.
[2] Includes small quantity of old mill cleanings.
[3] Includes value of 8,847 pounds of copper recovered from "cyanide" precipitates.

Ore and old tailings sold or treated in Nevada in 1931, by counties, with content in terms of recovered metals

County	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
DRY GOLD ORE						
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	1	5.83	24			
Clark	4,528	2,523.16	6,742	2,865	3,334	
Douglas	153	54.39	92			
Elko	69,579	25,808.42	243,264			
Esmeralda	[1] 277,424	15,976.52	8,803	1,179	3,871	
Eureka	1,165	303.77	1,009			
Humboldt	2,250	688.38	186	280		
Lander	5,885	2,666.87	2,440	3,867	1,841	
Lincoln	[2] 26	23.29	67			
Lyon	2,836	1,302.66	1,153			
Mineral	[3] 2,280	1,611.60	2,197			
Nye	45,777	23,045.73	57,583	559	281	
Pershing	9,811	6,373.12	11,200			
Storey	[4] 17,931	4,274.29	26,074	1,390	6,619	
Washoe	548	388.60	1,112			
White Pine	22,693	5,084.90	58,577	45,796		
	462,887	90,131.53	420,523	55,936	15,946	
Total, 1930	[5] 414,023	72,690.07	334,890	31,712	8,472	
DRY GOLD AND SILVER ORE						
Churchill	412	238.03	12,754			
Clark	1	.34	19			
Esmeralda	4,500	1,793.11	165,408			
Humboldt	18	11.45	787			
Mineral	1	3.80	222			
Nye	12,034	7,789.04	658,464			
White Pine	1,415	243.43	15,820	3,593		
	18,381	10,079.20	853,474	3,593		
Total, 1930	1,523	283.78	17,094	418	4,422	
DRY SILVER ORE						
Churchill	3	1.34	599			
Clark	1		343			
Esmeralda	434	145.33	40,685			
Lincoln	1		64			
Nye	47	7.58	4,303			
Pershing	3	.45	769			
White Pine	[6] 1,400	.66	2,395			
	1,889	155.36	49,158			
Total, 1930	127,503	20,057.67	2,126,025	943	6,493	
COPPER ORE						
Elko	1,080	626.00	1,758	49,472		
Esmeralda				[7] 9,358		
Humboldt	34		45	7,825		
Lander	848	705.71	1,294	138,570		
Lincoln	11,418	144.61	113,879	766,378		
Lyon	357			57,510		
Pershing	160	2.00	766	2,031		
White Pine	2,923,002	32,328.75	107,613	71,301,061		
	2,936,899	33,807.07	225,355	[7] 72,332,205		
Total, 1930	4,015,426	50,083.92	270,512	[8] 107,907,111	377,130	

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[1] Includes 274,000 tons of old tailings cyanided.
[2] Old tailings smelted.
[3] Includes 250 tons of old tailings cyanided.
[4] Includes 300 tons of old tailings cyanided.
[5] Includes small quantity of old mill cleanings.
[6] Old tailings cyanided.
[7] Includes 9,358 pounds of copper recovered from "cyanide" precipitates.
[8] Includes 8,847 pounds of copper recovered from "cyanide" precipitates.

Ore and old tailings sold or treated in Nevada in 1931, by counties, with content in terms of recovered metals—Continued

LEAD ORE

County	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	1	0.24	19		200	
Clark	[9] 20,421	3,135.88	5,558	6,022	293,089	
Elko	687	.61	13,893	1,528	282,235	
Esmeralda	46	.92	1,644		54,848	
Eureka	900	424.59	4,655	2,565	126,010	
Lander	15	7.00	409		4,131	
Lincoln	128	1.56	1,598	665	82,645	
Pershing	33	23.00	1,334	189	11,520	
White Pine	66	.44	405	137	77,874	
	22,297	3,594.24	29,515	11,106	932,552	
Total, 1930	10,413	1,037.94	148,033	36,003	2,213,843	
ZINC ORE						
Clark	75				10,788	41,004
	75				10,788	41,004
Total, 1930	158				8,720	91,008
COPPER-LEAD ORE						
Lincoln	3,824	53.74	53,136	139,373	480,622	
	3,824	53.74	53,136	139,373	480,622	
Total, 1930	30,171	383.51	258,792	1,225,225	2,560,850	
LEAD-ZINC ORE						
Clark	3,399				488,896	1,858,324
Lincoln	43,683	685.43	298,474	67,447	5,766,593	13,416,759
Nye	72,138	903.94	631,576	24,837	8,165,237	5,545,261
	119,220	1,589.37	930,050	92,284	14,420,726	20,820,344
Total, 1930	157,961	2,668.14	1,063,639	2,100	17,878,451	29,077,109

[9] Includes 10,110 tons of old tailings concentrated.

Zinc products from Nevada mines sold to mills and smelters in 1931

Classification	County	Ore (dry weight)	Gross zinc	Average assay of ore	Recovered zinc
		Short tons	*Pounds*	*Percent*	*Pounds*
Oxidized zinc ore	Clark	75	51,255	34.17	41,004
Oxidized and sulphide lead-zinc ore.	Clark, Lincoln, and Nye	119,220	23,142,930	9.71	20,820,344
		119,295	23,194,185	9.72	20,861,348
Total, 1930		158,119	33,628,782	10.63	29,168,117

METALLURGIC INDUSTRY

No new metallurgical plants were constructed in Nevada in 1931, but improvements were made at several old plants. At the Nevada Consolidated flotation plant existing facilities were rearranged to provide a secondary circuit and additional classification; two sections of the concentrator were changed over to the new flow sheet during the year, and similar rearrangement was completed in part on a third section of the original seven. Except for lead-zinc ore of the Combined Metals Reduction Co., which was shipped 316 miles by rail from Pioche to Stockton, Utah, all the milling ore was treated within the State. The Nevada Consolidated smelter at McGill was the only smelter to operate in Nevada; it treated copper concentrate from the Robinson district and purchased siliceous gold ores for converter lining. Other copper and lead ores and siliceous material produced in Nevada were shipped to smelters near Salt Lake City, Utah, and lead ores and gold bullion to Selby, Calif.; zinc concentrates were shipped to Silver King, Idaho, and Amarillo, Tex.

Mine production of metals in Nevada in 1931, by methods of recovery

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	33, 200	16, 685. 89	18, 695			
Ore and old tailings cyanided	417, 220	68, 038. 75	1, 110, 948			
Ore and old tailings smelted	[1] 78, 553	16, 803. 49	387, 849	[2] 3, 750, 421	1, 651, 246	1, 899, 328
Concentrates smelted:						
Flotation	151, 509	37, 607. 31	1, 041, 683	68, 882, 045	14, 209, 388	18, 962, 020
Table	48	275. 07	2, 036	2, 031		
Total, lode mines		139, 410. 51	2, 561, 211	72, 634, 497	15, 860, 634	20, 861, 348
Total, placers		2, 883. 25	860			
		142, 293. 76	2, 562, 071	72, 634, 497	15, 860, 634	20, 861, 348
Total, 1930		149, 064. 47	4, 219, 832	109, 203, 512	23, 058, 381	29, 168, 117

[1] Includes 26 tons of old tailings.
[2] Includes 9,358 pounds of copper recovered from "cyanide" precipitates.

Mine production of metals from gold and silver mills in Nevada in 1931, by counties, in terms of recovered metals

County	Ore and old tailings treated		Recovered in bullion			
	Ore	Old tailings	Amalgamation		Cyanidation	
			Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Churchill	83				31. 59	2, 484
Clark	4, 305		1, 463. 47	1, 688	869. 82	4, 827
Douglas	150		48. 24	90		
Elko	69, 572		800. 31	800	24, 994. 42	242, 254
Esmeralda	7, 247	[1] 274, 000	492. 66	186	14, 766. 81	204, 916
Eureka	1, 000		166. 15	28		
Humboldt	2, 203		509. 70	140		
Lander	5, 582		1, 850. 91	578	11. 76	3
Lyon	2, 787		1, 250. 11	919		
Mineral	1, 003	250	269. 49	196	309. 31	487
Nye	53, 361		6, 662. 80	3, 821	19, 968. 44	635, 285
Pershing	9, 783		606. 75	625	5, 614. 52	10, 250
Storey	16, 838	300	2, 070. 61	9, 471	1, 471. 42	8, 047
Washoe	540		357. 17	122		
White Pine	16	1, 400	137. 52	31	. 66	2, 395
	174, 470	[1] 275, 950	16, 685. 89	18, 695	68, 038. 75	1, 110, 948
Total, 1930	242, 365	[2 3] 278,230	9, 601. 13	8, 037	73, 946. 97	2, 232, 481

[1] Yielded also 9,358 pounds of copper contained in "cyanide" precipitates.
[2] Includes small quantity of old mill cleanings.
[3] Yielded also 8,847 pounds of copper contained in "cyanide" precipitates.

Mine production of metals from gold and silver mills in Nevada in 1931, by counties, in terms of recovered metals—Continued

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Esmeralda	58	955.63	313		2,871
Lander	6	13.25	146		
Mineral	5	31.00	336		
Nye	10	12.73	369		
Pershing	4	34.24	145		
Storey	3	5.89	132		
	86	1,052.74	1,441		2,871
Total, 1930	106	1,615.07	1,685	77	3,613

Gross metal content of concentrates from concentrating mills in Nevada in 1931, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	7	175.96	142			
Copper	120,723	31,928.60	106,698	71,629,439		
Lead	11,610	4,194.65	780,266	37,797	14,176,019	
Zinc	19,131	530.43	155,172	80,459	784,824	20,820,025
	151,471	36,829.64	1,042,278	71,747,695	14,960,843	20,820,025
Total, 1930	236,902	50,642.84	1,456,635	95,376,053	18,066,408	30,535,879

Nevada ore and old tailings concentrated in 1931, by methods of concentration

Method of concentration	Ore and old tailings concentrated	Concentrates and metal content		
		Concentrates produced [1]	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*
Flotation	3,035,639	151,451	36,651.68	1,041,370
Table	860	20	177.96	908
	3,036,499	151,471	36,829.64	1,042,278

Method of concentration	Concentrates and metal content—Continued					
	Copper		Lead		Zinc	
	Gross	Recovered	Gross	Recovered	Gross	Recovered
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Flotation	71,745,600	68,882,045	14,960,843	14,206,517	20,820,025	18,962,020
Table	2,095	2,031				
	71,747,695	68,884,076	14,960,843	14,206,517	20,820,025	18,962,020

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[1] Figures do not include 86 tons from ore first treated by amalgamation containing 1,052.74 ounces of gold 1,441 ounces of silver, and 3,023 pounds of lead (2,871 pounds recovered).

Mine production of metals from concentrating mills in Nevada in 1931, in terms of recovered metals

BY COUNTIES

	Ore and old tailings treated		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	10, 293	10, 110	303	3, 135. 71	5, 388	6, 022	274, 687	
Lincoln	43, 683		18, 124	685. 43	298, 474	67, 447	5, 766, 593	13, 416, 759
Mineral	700		7	175. 96	142			
Nye	72, 138		12, 314	903. 94	631, 576	24, 837	8, 165, 237	5, 545, 261
Pershing	160		13	2. 00	766	2, 031		
White Pine	2, 899, 415		120, 710	31, 926. 60	105, 932	68, 783, 739		
	3, 026, 389	10, 110	151, 471	36, 829. 64	1, 042, 278	68, 884, 076	14, 206, 517	18, 962, 020
Total, 1930	4, 014, 989		236, 902	50, 642. 84	1, 456, 635	92, 512, 329	17, 064, 331	26, 693, 794

BY CLASSES OF CONCENTRATES

Dry and siliceous			7	175. 96	142			
Copper			120, 723	31, 928. 60	106, 698	68, 785, 770		
Lead			11, 610	4, 194. 65	780, 266	29, 966	13, 467, 339	
Zinc			19, 131	530. 43	155, 172	68, 340	739, 178	18, 962, 020
			151, 471	36, 829. 64	1, 042, 278	68, 884, 076	14, 206, 517	18, 962, 020

Gross metal content of Nevada concentrates produced in 1931, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	93	1, 228. 70	1, 583		3, 023	
Copper	120, 723	31, 928. 60	106, 698	71, 629, 439		
Lead	11, 610	4, 194. 65	780, 266	37, 797	14, 176, 019	
Zinc	19, 131	530. 43	155, 172	80, 459	784, 824	20, 820, 025
	151, 557	37, 882. 38	1, 043, 719	71, 747, 695	14, 963, 866	20, 820, 025
Total, 1930	237, 008	52, 257. 91	1, 458, 320	95, 376, 171	18, 070, 212	30, 535, 879

Mine production of metals from Nevada concentrates in 1931, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	303	3, 135. 71	5, 388	6, 022	274, 687	
Esmeralda	58	955. 63	313		2, 871	
Lander	6	13. 25	146			
Lincoln	18, 124	685. 43	298, 474	67, 447	5, 766, 593	13, 416, 759
Mineral	12	206. 96	478			
Nye	12, 324	916. 67	631, 945	24, 837	8, 165, 237	5, 545, 261
Pershing	17	36. 24	911	2, 031		
Storey	3	5. 89	132			
White Pine	120, 710	31, 926. 60	105, 932	68, 783, 739		
	151, 557	37, 882. 38	1, 043, 719	68, 884, 076	14, 209, 388	18, 962, 020
Total, 1930	237, 008	52, 257. 91	1, 458, 320	92, 512, 406	17, 067, 944	26, 693, 794

BY CLASSES OF CONCENTRATES

Dry and siliceous	93	1, 228. 70	1, 583		2, 871	
Copper	120, 723	31, 928. 60	106, 698	68, 785, 770		
Lead	11, 610	4, 194. 65	780, 266	29, 966	13, 467, 339	
Zinc	19, 131	530. 43	155, 172	68, 340	739, 178	18, 962, 020
	151, 557	37, 882. 38	1, 043, 719	68, 884, 076	14, 209, 388	18, 962, 020

Gross metal content of Nevada crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	32,011	14,389.46	191,862	62,290	15,659	
Copper	37,324	1,878.47	118,657	3,672,524		
Lead	1,894	458.53	24,127	7,377	692,540	
Zinc	75				15,411	51,255
Copper-lead	3,824	53.74	53,136	163,968	505,918	
Lead-zinc	3,399				698,428	2,322,905
	78,527	16,780.20	387,782	3,906,159	1,927,956	2,374,160
Total, 1930	221,593	11,396.65	520,145	17,387,033	7,020,634	3,092,903

Mine production of metals from Nevada crude ore shipped to smelters in 1931, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	334	213.85	10,912		200	
Clark	3,717	190.38	759	2,865	521,420	1,899,328
Douglas	3	6.15	2			
Elko	1,774	640.30	15,861	51,000	282,235	
Esmeralda	1,157	1,700.78	11,125	1,179	55,848	
Eureka	1,065	562.21	5,636	2,565	126,010	
Humboldt	99	190.13	878	8,105		
Lander	1,166	1,503.66	3,416	142,437	5,972	
Lincoln	15,371	199.91	168,677	906,416	563,267	
Lyon	406	52.55	234	57,510		
Mineral	328	829.64	1,258			
Nye	4,497	4,198.38	80,875	559	281	
Pershing	64	141.06	2,283	189	11,520	
Storey	793	726.37	8,424	1,390	6,619	
Washoe	8	31.43	990			
White Pine	47,745	5,593.40	76,452	2,566,848	77,874	
	78,527	16,780.20	387,782	3,741,063	1,651,246	1,899,328
Total, 1930	221,593	11,396.65	520,145	16,682,259	5,990,437	2,474,323

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	32,011	14,389.46	191,862	59,529	13,075	
Copper	37,324	1,878.47	118,657	3,537,077		
Lead	1,894	458.53	24,127	5,084	657,865	
Zinc	75				10,788	41,004
Copper-lead	3,824	53.74	53,136	139,373	480,622	
Lead-zinc	3,399				488,896	1,858,324
	78,527	16,780.20	387,782	3,741,063	1,651,246	1,899,328

REVIEW BY COUNTIES AND DISTRICTS

CHURCHILL COUNTY

The value of the mine production of metals in Churchill County increased from $3,613 in 1930 to $8,966 in 1931. The output of gold and silver increased, but both the quantity and value of copper and lead decreased.

Alpine district.—A little lead ore containing silver and gold was shipped to the Selby smelter in California from the Nevada Gold property 79 miles by road east of Fallon.

Wonder district.—Production in the Wonder district consisted of 416 tons of ore yielding $5,069 in gold and 13,377 ounces of silver, valued together at $8,948, or $21.51 in metals a ton. Most of the output was siliceous gold-silver ore shipped to a smelter; some silver ore was treated by cyanidation at the custom plant at Millers near Tonopah. The output was chiefly from the Wonder mine and two new locations, the Jackpot and Florence. The district had not produced since 1926.

CLARK COUNTY

The value of the mine production of metals in Clark County in 1931 was $223,101, or $22,792 more than in 1930. The output of ore and old tailings increased from 10,458 to 28,425 tons.

Crescent district.—Three lode mines in the Crescent district produced 121 tons of ore yielding $1,434 in gold, 57 ounces of silver, and 3,334 pounds of lead, valued in all at $1,573, or $13 in metals a ton. All the ore was shipped to a lead smelter in Utah. Two lots of gold ore containing a little lead were produced by the Nippeno Mining Co. and similar ore was produced by the Cumberland and Crescent lode mines.

Eldorado Canyon district.—Output in the Eldorado Canyon district consisted of 3,689 tons of ore, yielding $44,952 in gold and 6,436 ounces of silver, from the Eldorado-Rand mine. The ore was treated in a 25-ton amalgamation and cyanidation plant operated continuously from March to December. The mill equipment consists of ten 1,000-pound stamps. The ore is crushed to 40-mesh, and the pulp is passed over plates; the sands and slimes are leached in cyanide solution.

Searchlight district.—Eight lode mines in the Searchlight district produced 20,855 tons of ore and old tailing yielding $67,727 in gold, 5,826 ounces of silver, 6,022 pounds of copper, and 274,687 pounds of lead, valued in all at $80,129, or $3.84 in metals a ton. The district output increased after March, when the Searchlight Gold Corporation began regular operation. The company did a limited amount of underground work in the Duplex mine and re-treated the tailing dumps. Flotation was used during 1931; most of the material treated was old tailing, but it included both crude ore and old mine-dump material too low in grade to treat by any other method. The old tailing was recovered by means of automatic dumping scrapers drawn by gasoline tractors and dumping into a hopper and belt conveyor to the mill bin. A 5-foot cylindrical ball mill charged with flint pebbles, operating in closed circuit with a 6-by 22-foot Dorr Duplex classifier, reduces the material to flotation size. A new 6-cell Kraut machine and a 10-cell Fahrenwald machine in series produce the concentrate. No gravity concentration equipment was installed. Concentrates are also thickened and filtered on a small Oliver machine.[3] Nearly all the remainder of the district output was ore treated by amalgamation from the Hudgen's lease on the Quartette mine and from the New Era and Big Casino properties.

Yellow Pine district (*Goodsprings*).—Nine lode mines in the Yellow Pine district produced 3,759 tons of ore yielding $2,817 in gold, 341 ounces of silver, 2,865 pounds of copper, 518,086 pounds of lead, and 1,899,328 pounds of zinc, valued in all at $94,520, or $25.14 in metals a ton. The value of the district output in 1930 was $171,269. No milling ore was reported from the zinc-lead mines, but ore from the

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[3] From field notes of C. N. Gerry and T. H. Miller, both of the Bureau of Mines.

Keystone mine yielded some gold bullion. With this exception all the ore produced was mixed zinc-lead ore shipped to the Ozark Smelting & Mining Co. at Coffeyville, Kans. The Yellow Pine Mining Co. continued as the largest producer in the district; it shipped 1,900 tons of ore. The next largest production (681 tons) was made by the lessees of the Anchor mine, followed by the Argentena (615 tons), the Bullion (176 tons), the Shenandoah (93 tons), and the Milford and Addison (27 tons). A lessee worked at the Boss mine part of the year and shipped 71 tons of copper ore to the Garfield smelter in Utah. Usually, the ore from the Boss mine carries platinum and palladium, but no report was received giving its content.

DOUGLAS COUNTY

Three lode mines in Douglas County in 1931 produced $1,124 in gold and 92 ounces of silver, valued together at $1,151. No production was reported for 1930. The Golden Eagle mine in the Delaware district was under development, and 150 feet of new work were done. A small stamp mill was operated intermittently during the first 2 months of the year and treated 150 tons of gold ore by amalgamation. From the Early Sunrise group a test lot of gold ore was shipped to the Selby smelter in California. The property is opened by a 120-foot tunnel. During development work a little gold ore was produced from prospects in the Red Canyon district. The Lucky Bill mine, a producer in 1929, was developed and its 500-foot tunnel extended 50 feet.

ELKO COUNTY

Twenty lode mines in Elko County in 1931 produced 71,346 tons of ore yielding $546,460 in gold, 258,915 ounces of silver, 51,000 pounds of copper, and 282,235 pounds of lead, valued in all at $636,629, or $8.92 in metals a ton. One placer operation yielded less than $100 in gold.

Centennial (*Edgemont*) *district.*—No production was reported from the Centennial district for 1931, but two mines which were important producers between 1902 and 1910 were reopened. Most of the ore formerly produced in the district was highly siliceous, with nearly an ounce of gold and an ounce of silver to the ton. According to recorded reports of the producers, the total output of gold and silver during 8 years of mining was valued at $931,061. The Lucky Girl mine, equipped with a 20-stamp amalgamation-gravity concentration-cyanidation plant, was the largest producer during the period mentioned. The old mill equipment was partly replaced late in 1931 with a 50-ton Marcy ball mill and a Denver Sub-A 6-cell 18-inch flotation machine. The Bull Run Gold Mining Co. property was an important producer of gold and silver in 1902 and 1903. Recently, a 15-ton amalgamation and cyanidation plant was added to the property, and some experimental work was done on the ore.

Charleston district.—The Black Warrior mine in the Charleston district produced 192 tons of ore, which was treated in a 10-ton cyanidation plant constructed in May. The mine is opened by a 250-foot tunnel, to which some new development was added.

Contact district (*Salmon River*).—The output in the Contact district consisted of two small lots of copper ore and gold ore left from 1930 mine operations; the ore was shipped to a smelter in Utah.

Delano district.—From two lode mines—the Net No. 2 and Blue Bell—in the Delano district 528 tons of lead ore were shipped to the smelter. The mines were closed in April, as low metal prices made it impossible to ship ore with profit.

Gold Circle district (*Midas*).—Three lode mines and some prospecting in the Gold Circle district produced 4,841 tons of ore yielding $55,413 in gold and 31,798 ounces of silver, valued together at $64,634, or $13.35 in metals a ton. Most of the ore was from the Missing Link mine dumps; it was loaded on trucks and hauled to the 75-ton continuous decantation cyanidation mill of the Gold Circle Consolidated Mines, which owns the Elko Prince, Rex, Big Chief, Missing Link, and Grant claims. The Buena Gold Mines, Inc., operated the Esmeralda-Esperanza group and the 15-ton amalgamation mill which was moved nearer to the water supply 5 miles from the mine. Operations were continuous, beginning in March. The claims are developed by a 3,000-foot tunnel and a 350-foot vertical shaft. A little gold bullion from prospecting quartz claims in the district was sold to the mint. The geology and ore deposits of the Gold Circle district are described in a recent report.[4]

Jarbidge district.—Four lode mines in the Jarbidge district produced 64,442 tons of ore yielding $476,630 in gold and 211,246 ounces of silver, valued together at $537,891, or $8.35 in metals a ton. The Elkoro Mines Co., the second largest producer of gold in Nevada in 1931, continued to operate the Long Hike, Starlight, and other claims. The 150-ton cyanidation plant was in continuous operation and treated a total of 63,617 tons of ore in 1931. According to the annual report of the company[5] the ore had an average value of $8.35 a ton compared with 57,539 tons and $9.33 in 1930. The gross value of the 1931 output was $531,328.95, and after costs amounting to $390,062.54 were deducted a net operating gain of $141,266.41 remained. The printed report of the company says:

> For the last three years exploration has failed to add to the ore reserves. The known reserves are yielding somewhat more ore than was anticipated and now seem likely to last through the first half of 1932; but any further prolongation of this mine's life is dependent on finding new ore bodies. Exploration is being continued.

In 1931 more than 5,000 feet of exploration and development were done at the mine. A recent report[6] on costs and methods of mining emphasizes the fact that no definite plan of development could be decided upon at the Elkoro mine in advance, owing to irregularity of the ore bodies, characteristics of which are described.

The Bluster and Success properties were worked, and the ore mined was treated in the 5-stamp amalgamation mill at the Bluster mine.

Lime Mountain (*Deep Creek*) *district.*—Siliceous ore averaging $12 in gold and 1.6 ounces of silver to the ton and 2 percent copper was shipped from the Eldorado mine in the Lime Mountain district. From June to the end of the year two 6-ton trucks hauled ore to Elko for shipment to a smelter in Utah.

Mountain City (*Cope, Van Duzer*) *district.*—No production was reported from the Mountain City district, but active development work was started in June on the Rio Tinto copper property. An incline shaft 85 feet deep and some other work on the copper deposit were continued. Samples from the leached iron gossan of the vein outcrop averaged 0.03 ounce of gold and 3.2 ounces of silver to the ton and 8.6 percent copper.

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[4] Rott, E. H., jr., Ore Deposits of the Gold Circle Mining District, Elko County, Nev.: Univ. Nevada Bull. 5, 1931, 30 pp.

[5] Yukon Gold Co. Twenty-third Ann. Rept., for year ended Dec. 31, 1931.

[6] Park, J. F., Mining Practices, Methods, and Costs at Elkoro Mines, Jarbidge, Nev.: Inf. Circ. 6543, Bureau of Mines, 1931, 12 pp.

Rowland district.—The Bruneau Consolidated Gold Mines, a producer of gold in 1926, 1927, and 1930, was idle in 1931. A small quantity of gold amalgam, cyanide precipitates, and slag marketed in 1931 was the result of a mill clean-up.

Spruce Mountain district.—Three lode mines in the Spruce Mountain district produced 130 tons of ore yielding $13 in gold, 1,167 ounces of silver, 1,528 pounds of copper, and 52,189 pounds of lead, valued in all at $2,422, or $18.63 in metals a ton. In 1930 the district output was 1,122 tons of ore yielding metals valued at $24,684, or $22 to the ton. The output in 1931 consisted of small lots of lead ore from the Bullshead, Humbug, and Kille properties. The Centennial Consolidated Mining Co. began development of the Hartley mine in July. A recent report[7] describes the geology and ore deposits of the Spruce Mountain district.

Tecoma district.—One lot of oxidized lead ore from the Jackson mine was shipped to a smelter in Utah.

Tuscarora district.—A little sulphide ore containing gold and silver was shipped to a Utah smelter from the Nevada-Queen lease. The Tuscarora Dexter Gold Mining Co. developed the Dexter mine; a lessee recovered a little gold from surface operations.

ESMERALDA COUNTY

Esmeralda County showed the third largest decrease in the State in 1931 in total value of metals produced. The output of gold, silver, copper, and lead was valued at $436,696, a decrease of $770,614 from 1930. Silver decreased 1,217,413 ounces in quantity and $489,276 in value and gold $281,734.

Desert district (*Gilbert*).—Five lode mines in the Desert district produced 239 tons of ore yielding $6,218 in gold and 511 ounces of silver, valued together at $6,366, or $26.64 in metals a ton. In 1930 the district output was 414 tons of ore averaging $22.33 a ton in gold, silver, and copper. Most of the output in 1931 was treated at the Desert custom mill at Millers; only 30 tons of siliceous gold ore were shipped from Gilbert to a smelter in Utah. The Green Gold property was the largest producer of siliceous gold ore. The Mammoth is developed to a depth of 360 feet by a vertical shaft and 500 feet of drifts.

Divide (*Gold Mountain*) *district.*—Output in the Divide district was 434 tons of siliceous silver ore yielding $3,004 in gold and 40,685 ounces of silver, valued together at $14,803, or $34.11 in metals a ton. All the ore was produced by lessees from the surface workings of the Tonopah Divide Mining Co. Only one small lot of silver ore was shipped to a smelter in California, the remainder was treated by cyanidation at the Millers custom plant of the Tonopah Mining Co.

Goldfield district.—One placer, five lode mines, and one mill-tailing dump in the Goldfield district reported $267,071 in gold, 6,359 ounces of silver, and 10,537 pounds of copper, valued in all at $269,874. The output of ore and old tailings consisted of 222 tons of crude ore and

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[7] Schrader, F. C., Spruce Mountain District, Elko County, and Cherry Creek (Egan Canyon) District, White Pine County: Univ. Nevada Bull. 7, 1931, 39 pp

274,000 tons of old tailings treated at cyanidation plants and 364 tons of siliceous gold-silver ore shipped to a smelter in Utah. The total output of the district is given in the following table:

Mine production of gold, silver, copper, and lead in the Goldfield district, Esmeralda County, Nev., 1903–31

Period	Ore and old tailings		Gold [1]	Silver [1]	Copper	Lead	Total value
	Ore	Old tailings					
	Short tons	*Short tons*		*Fine ounces*	*Pounds*	*Pounds*	
1903–10	893,334		$45,130,812	297,773	160,903		$45,323,025
1911–20	2,914,281		37,300,661	1,045,780	7,391,660	27,540	39,406,548
1921–30	28,196	934,000	1,817,220	46,712	51,513	5,950	1,854,454
1931	586	274,000	267,071	6,359	10,537		269,874
Total, 1903–31	3,836,397	1,208,000	84,515,764	1,396,624	7,614,613	33,490	[2] 86,853,901

[1] Includes placer production.
[2] Dividends paid by 9 companies to end of 1931 totaled $33,227,809.

Less gold than in 1930 was produced from the Goldfield Consolidated tailing dump, under lease to Bradshaw, Inc., who operated only 263 days, due to successive floods which washed out the water system. The 1,000-ton cyanidation plant of the company required 4,500,000 gallons of water a month, 2,500,000 gallons from the Goldfield Water Co. and the rest from the Jupiter mine shaft. Dividends paid in 1931 by Bradshaw, Inc., amounted to $56,842.12, which added to the distribution to stockholders in 1930 totals $151,579. Work was begun in the Goldfield Consolidated mine by a number of lessees, who produced 342 tons of ore while developing and prospecting old mine stopes. According to its report to stockholders, the Goldfield Deep Mines Co. completed a 3-compartment vertical shaft to a depth of 2,335 feet and at 2,750 feet encountered vein quartz as shown by drill cores. Due to lack of financial support additional shaft sinking was abandoned. The pumps were raised to the 800-foot level, beyond which the water is not expected to rise. Through a tax sale the Florence mine was added to the territory owned by the Goldfield Deep Mines Co.; a new discovery near the surface was opened by lessees, and their output was reported by the company. At the Diamondfield Daisy mine new ore was uncovered in the Kretz-Stahl lease 65 feet from the surface, and 50 tons were treated at the Millers cyanidation plant. Development of the Pittsburgh-Goldfield property was continued with a 3-compartment shaft, and water was encountered at a depth of 750 feet.

Hornsilver district.—One car of siliceous gold ore from the Hattie L No. 3 claim of the Great Western property of the Ohio Mines Co. was shipped to Millers for treatment by cyanidation. Development work opened up considerable mill ore in the 600-foot shaft, of which 80 feet were completed in 1931.

Lookout Mountain district.—The Red Top mine, opened by a 300-foot vertical shaft, produced 50 tons of siliceous ore yielding a little gold and silver; the ore was treated by amalgamation in the 10-ton Straub mill on the property.

Montezuma district.—Lessees operated the Harmill Divide property and shipped lead ore averaging $55 a ton in gold, silver, and lead to a smelter in Utah.

Oneota (*Buena Vista*) *district.*—A lessee worked the Brownie mine and produced a little gold bullion from ore treated by amalgamation.

Silver Peak district.—Several lessees operated the Mary mine under lease to the Lucky Boy Divide Mining Co., controlled in turn by the Black Mammoth Consolidated Mining Co., and shipped gold bullion, siliceous ore, and arsenical concentrates containing gold and silver to the smelters. About 1,800 tons of ore were milled in the Mammoth amalgamation and flotation mill. The Valcalda mine and mill of the Oromonte Mines Co. were not operated in 1931. Some gold precipitate from the treatment of old tailing in the Fachini cyanide plant was shipped to a smelter. The Calumet Gold Mining Co. began development of the Great Gulch claim, a former producer, about 1½ miles from the Mary property.

According to Spurr,[8] the first discovery in the Silver Peak district was in 1864. The Blair mill was built in 1867 and during its operation produced gold and silver valued at $1,080,000. Spurr estimated the value of all metals produced from 1867 to the end of 1905 at $1,196,000. The total value of the metal output from 1906 to 1931 is given in the following table:

Mine production of gold, silver, copper, and lead in the Silver Peak district, Esmeralda County, Nev., 1906–31

Period	Ore	Gold	Silver	Copper	Lead	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	
1906–10	450, 154	$2, 717, 620	53, 441	----------	33, 086	$2, 747, 506
1911–20	702, 483	3, 223, 495	125, 745	8, 765	80, 723	3, 305, 144
1921–30	23, 009	454, 824	25, 438	333	6, 405	471, 894
1931	2, 512	56, 401	1, 243	----------	3, 871	56, 904
Total, 1906–31	1, 178, 158	6, 452, 340	205, 867	9, 098	124, 085	6, 581, 448

Tonopah district.—A little mining was done in the western part of the Tonopah district in Esmeralda County by the Tonopah Extension Mines, Inc. The figures of output are included in the review of the Tonopah district under Nye County. A geologic resurvey of the Tonopah district in Esmeralda County was recently made and a paper published.[9]

EUREKA COUNTY

Thirteen lode and placer mines in Eureka County in 1931 produced gold, silver, copper, and lead valued at $26,916, a decrease of $34,967 from 1930. The largest decreases were in quantity and value of silver and lead.

Buckhorn (*Mill Canyon*) *district.*—The Buckhorn mine, 18 miles easterly from Alpha station on the Eureka Nevada Railway, was opened by a lessee who did about 200 feet of development work and shipped nearly 200 tons of siliceous gold ore to a smelter in Utah.

Cortez and Bullion district.—Small lots of lead ore were shipped to smelters from the Majestic and Lakin's Lime Point or Golden properties under development by the Roberts Mining & Milling Co. and the Trinity Gold Mining Co., respectively. Assessment work only has been done on the silver property of the Consolidated Cortez Silver Mines Co. since July 1930, when a receiver for the company was appointed.

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[8] Spurr, J. E., Ore Deposits of the Silver Peak Quadrangle, Nev.: U.S.Geol. Survey Prof. Paper 55, 1906, pp. 34–74.

[9] Nolan, T. B., The Underground Geology of the Western Part of the Tonopah Mining District, Nev.: Univ. Nevada Bull. 4, 1930, 34 pp.

Eureka district.—Four lode mines in the Eureka district shipped to smelters 888 tons of ore yielding $8,609 in gold, 4,040 ounces of silver, 2,565 pounds of copper, and 124,374 pounds of lead, valued in all at $14,616, or $16.46 in metals a ton. Most of the output was lead ore from the Richmond-Eureka property.

Lynn district.—The Trinity Gold Mining Co., subsidiary of the Nevada-Mexico Mining Co., developed the Big Six mine and milled about 1,000 tons of ore yielding gold bullion which was shipped to the mint. Placer bullion recovered from material worked with rockers and dry-washing machines yielded $5,316 in gold and 21 ounces of silver. Most of the bullion came from the Bull Dog and Arrowhead claims.

HUMBOLDT COUNTY

The value of the mine production of metals in Humboldt County increased from $3,947 in 1930 to $15,846 in 1931; $14,466 of the output in 1931 was in gold from lode mining.

Amos (*Slumbering Hills*) *district.*—Four properties in the vicinity of Daveytown mined and treated by amalgamation 231 tons of ore yielding $3,389 in gold and 56 ounces of silver, valued together at $3,405, or $14.74 in metals a ton. Most of the ore was from the Daveytown mines. A Swett's muller mill of 4 tons daily capacity was used to treat the ore.

Cove and Leonard Creek districts.—Some gold bullion was recovered from ore treated in the Josie Pearl amalgamation mill in Cove Canyon. In the Leonard Creek section considerable activity was reported, but little gold was produced. The Leonard Creek Placers, Ltd., was organized to develop the Mattinson property, worked in a small way during the past 5 years by ground-sluicing and dry-washing methods when no water was available. The output of the region in 1931 did not exceed $1,000.

Sawtooth (*Mandalay*) *district.*—Ten dry-washing machines were reported working at one time on placer gravel in the Sawtooth district. A little gold 0.880 fine reported by a bullion buyer at Sulphur was said to have been recovered from placers.

Sherman district.—Gold bullion and concentrate were produced by the Basque Mining & Milling Co. About 340 feet of drifts and 200 feet of raises were done in the mine, which is opened by 900 feet of tunnel work. The mine and amalgamation-gravity concentration plant were operated continuously to November 1.

Winnemucca (*Barrett Springs, Platinum*) *district.*—The Tacoma group of claims at Barrett Springs 10 miles northwest of Winnemucca was under development by the Nevada Consolidated Mines Co. The property is opened by an incline shaft 260 feet deep and has 4,000 feet of tunnels and drifts. About 600 feet of work were done during the year in reopening the property, and a test lot of gold-silver ore was shipped to a smelter. At the Reo and Rawgold mine in the Platinum section of the Winnemucca district a little gold averaging 0.767 fine was recovered from ore ground in hand mortars.

LANDER COUNTY

Lode and placer mines in Lander County produced gold, silver, copper, and lead valued at $102,870 in 1931, compared with $220,813 in 1930. Gold was the only metal to increase in output. Copper showed substantial decrease and accounted for the large loss in total value of metals.

Battle Mountain (Copper Basin, Copper Canyon, Galena) district.—Placers and lode mines in the Battle Mountain district produced 1,037 tons of ore, $35,731 in gold, 2,213 ounces of silver, 138,712 pounds of copper, and 4,045 pounds of lead, valued in all at $49,145. The ore had an average value of $29.70 in metals a ton. The placer output consisted of $18,310 in gold and 113 ounces of silver, valued together at $18,342. Most of the output was copper ore shipped to smelters in Utah. A little ore was treated by amalgamation and some by cyanidation, and tests were made by flotation. Copper ore shipped amounted to 848 tons, containing nearly an ounce of gold to the ton. The gold content is a decided increase over that of former shipments of copper ores to the smelters, due largely to the recent discovery of a new gold vein beyond a fault which cut off the copper deposits. The new gold vein was opened on the property of the Copper Canyon Mining Co. at Copper Canyon, 17 miles south of Battle Mountain. The ground had hitherto been known as a producer of ore in which copper predominated, but the new deposit carries principally gold. Twelve car lots of ore shipped before the end of the year carried 7 to 12 ounces of gold to the ton. No work was done on company account, but about 14 lessees were at work in the mine and in the placers below it. At the Copper Basin mine 7½ miles southwest of Battle Mountain, also owned by the Copper Canyon Mining Co., recent shipments of copper ore assayed 16 to 19 percent copper. At the placers a new channel lying above that previously mined yielded gravel reported to average $40 a yard in several places. As several large bowlders of copper ore have been found in the channel, miners believe much of the gold was derived from the copper deposit east of the placers. Various lessees at the Dahl drift placers produced gold 0.875 fine; the new owner reworked 2,500 cubic yards of old placer tailings, using a drag-line excavator. At Galena, 10 miles from Battle Mountain, flotation tests were made on ore treated in a 30-ton mill at the Wedge mine. One lot of gold concentrate was shipped to the smelter. A small amount of development was done in the mine, which is opened by a 110-foot incline shaft. The Modoc claim, opened by shallow shafts, was further developed by 40 feet of shaft work and 100 feet of drifts. Besides 25 tons of ore treated by amalgamation and gravity concentration, 14 tons of ore and 2 tons of gold concentrate were shipped to a smelter. The Buffalo Valley Mines Co. operated its gold property and small cyanidation plant and shipped some gold bullion. The property is in the northwestern part of the district and is reached by way of Valmy. From the Ruth mine, 6 miles south of Battle Mountain, copper ore averaging 9.2 percent copper was shipped. Further prospecting, with some diamond-drill work, on the Imperial property 14 miles south of Battle Mountain was discontinued without the Treadwell Yukon Co., Ltd., exercising its option.

Bullion district.—One lot of siliceous gold ore was shipped to a smelter from the Gold Quartz mine near Tenabo. The Lovie mine on Indian Creek was prospected by the Nevada-Mexico Mining Co., but no ore was shipped. Dry washing of placer or surface material south of Camp Raleigh resulted in production of a little gold.

Hilltop district.—The mine dump of the Hilltop property was worked by a lessee who shipped two lots of ore averaging 2.4 ounces of gold to the ton and 2 percent copper.

Lewis district.—At Lewis the Treasure Vault claim and two other properties produced gold, silver, copper, and lead valued in all at $1,409. The Treasure Vault was under development by lessees who shipped siliceous ore carrying gold, silver, copper, and lead.

McCoy district.—Lessees continued to work the property of the Nevada Gold Dome Mining Co. and adjoining properties and produced over 500 tons of ore; 40 tons were first-class gold ore shipped to a smelter, and the remainder was treated by amalgamation in a small Huntington mill. According to newspaper[10] reports some of the richest ore was found on the 150-foot level of the mine.

New Pass district.—The New Pass Gold Mines Co., leasing the Yellow Bull property, produced gold bullion and concentrate from 4,930 tons of ore treated in an amalgamation-gravity concentration mill. The largest shipment of bullion to the mint (1,101 ounces) assayed 0.816 fine in gold. The mine is developed by 4,000 feet of tunnels driven by former owners, but no development in 1931 was reported by the present company.

LINCOLN COUNTY

The mine production of metals in Lincoln County was valued at $986,940, a decrease of $1,336,111 from 1930 and the second largest decrease in the State in total value of metals produced. There were decreases in both quantity and value of all metals, with large losses in value of silver, copper, lead, and zinc. Six lode mines produced 59,080 tons of ore and old tailings, of which 43,683 tons were milling ore and 15,371 tons first-class smelting ore.

Eagle Valley district.—Old tailings shipped from the Horse Shoe mine in 1931 averaged nearly an ounce of gold to the ton. The mine has not been operated since 1908.

Ferguson (Delamar) district.—No production was reported from the Ferguson district; but the Magnolia mine was developed by the Delamar Exploration Co., and preparations were made to ship low-grade siliceous ore to the Garfield smelter in Utah. Also, the Caliente Cyaniding Co. contracted to ship tailings for use as flux at the Garfield smelter.

Groom district.—The Groom property produced over 56 tons of 59.6 percent lead ore carrying 15 ounces of silver to the ton. About 320 feet of development work were done in 1931.

Jack Rabbit district.—Operations at the property of the Bristol Silver Mines Co. ceased in June because of low metal prices. Up to the time of closing 1,000 feet of development work were done, and about 15,000 tons of copper-lead ore were shipped to a smelter in Utah. The mine was the third largest producer of lead and copper in Nevada.

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[10] Reno Evening Gazette, Mar. 17, 1931.

Patterson (*Geyser*) *district.*—Production of siliceous silver ore in 1921, 1922, and 1923 and of lead-silver ore in 1925 was from the Lake Valley Mining & Milling Co. and the Ely Pioche Amalgamated Lead-Silver Mines, respectively. The former treated ore in a cyanidation plant at the mine and the latter shipped ore to a smelter. According to a recent report,[11] in which the geology and ore deposits are described, some development work was done in 1930 on the Cave group.

Pioche district.—The Combined Metals Reduction Co. continued operations at its Pioche property and produced 43,683 tons of lead-zinc ore, which was shipped to Stockton, Utah, for treatment in its 800-ton flotation plant; the property was first in output of zinc in Nevada in 1931, second in lead, and third in silver. Development during 1931 included 1,994 feet of drifts and raises and 2,663 feet of diamond drilling. Some of this development was done to find the extension of the Raymond Ely and Meadow Valley vein systems. At the Castleton 1,400-foot 4-compartment vertical shaft sinking in quartzite was nearly completed, and water was being pumped at the rate of 390 gallons a minute. The lower level of this shaft will be connected with a drift driven east to connect with the 1,200-foot level driven from the No. 1 shaft.

LYON COUNTY

Sixteen lode mines and one placer property in Lyon County produced gold, silver, and copper valued at $32,575 in 1931, compared with a county output of metals valued at $56,730 in 1930. The output of gold increased, but both quantity and value of silver, copper, and lead decreased. Most of the ore produced in the county was treated by amalgamation.

Palmyra district (*Como*).—The Pony Meadows group of claims was combined with the Stone Cabin group in 1931, and the Pony Meadows 30-ton flotation mill was changed to operate by electric power instead of gasoline. No ore was milled, but two small lots of gold ore were shipped to a smelter.

Silver City district.—Thirteen lode mines and one placer produced 2,788 tons of ore, $25,949 in gold, and 922 ounces of silver, valued together at $26,216. All the ore was treated by amalgamation and the current sands were treated by cyanidation; the ore had an average recovery value of $9.37 in metals a ton. About 50 sets of lessees were reported active in the district. The largest output of ore was from the Haywood mine, worked by lessees, who treated the ore in the Trimble amalgamation mill. This custom milling plant also reduced ore from the Spring Valley (Metropolitan) group and the Golden Fleece, Pedroli, Byers & Murphy, and Milwaukee mines. The McTigue mill of the Comstock Speculator Mining Co. was operated a short time on Flora Temple ore; a new hoist installed at the shaft was completed to a depth of 108 feet. One small lot of placer gold was produced from Gold Canyon.

Yerington district.—Lessees on the Bluestone and Mason Valley property of the Eastern Iron & Metal Co. shipped 357 tons of 8.3 percent copper ore to a smelter in Utah.

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[11] Schrader, F. C., Notes on Ore Deposits at Cave Valley, Patterson District, Lincoln County, Nev.: Univ. Nevada Bull. 3, 1931, 16 pp.

MINERAL COUNTY

The value of metals produced in Mineral County in 1931 increased from $26,699 in 1930 to $34,475 in 1931, due to increased output of gold. No copper or lead was produced in 1931, and the silver output decreased in both quantity and value.

Bell district (*Simon, Mina*).—Old tailing and gold ore (468 tons) from the Olympic property were treated in the cyanide mill at Omco, and siliceous gold ore (156 tons) was shipped to a smelter in Utah. The Simon Silver-Lead Mines, Inc., at Simon continued to maintain its gold-silver-lead-zinc property by not permitting the mine to fill with water. A total of 750 feet of development work was done on the 800-, 900-, and 1,000-foot levels, during which an average of nine men a day was employed. The 200-ton flotation mill was idle. Further development of the mine awaits better metal prices.

East Walker Lake district.—From the Flora May property some gold bullion 0.695 fine was shipped to the San Francisco Mint. The property is equipped with a small amalgamation mill.

Hawthorne district (*Pamlico*).—Tests of ore from the Pamlico mine resulted in the shipment of bullion 0.795 fine to the Carson City Mint.

Pilot Mountains (*Sodaville*) *district*.—Nine tons of rich ore, some of it assaying 463 ounces of gold and 321 ounces of silver to the ton, were shipped to a smelter from the Belleville property in Telephone Canyon southeast of Mina. Two lots of bullion 0.623 fine in gold were shipped to the mint. Most of the development work was done in the lower 235-foot tunnel.

Regent district (*Rawhide*).—Small quantities of high-grade ore shipped to a smelter and bullion recovered from gold ore treated by amalgamation yielded metals valued at $2,294, or $19.78 to the ton of ore. Sluicing of erosion material from quartz veins yielded $378 in gold and 10 ounces of silver.

Silver Star district (*Marietta, Black Mountain, Gold Range, Douglass*).—Six lode mines in the Silver Star (better known as the Gold Range) region produced 1,232 tons of ore yielding $15,222 in gold and 1,061 ounces of silver, valued together at $15,229, or $12.60 in metals a ton. The entire output, except 157 tons of first-class smelting ore, was gold ore treated by amalgamation and flotation. The Kernick Divide Mining Co., operating the Gold Crow and other claims, treated about 700 tons during the brief operation of its flotation mill. The ore yielded a very rich gold concentrate, but due to the grade of the ore and the high cost of reduction the company creditors began action and the company passed into the hands of a receiver. Gold ore from the Mary Ann, Douglass, and Fortuna Fraction was treated in a 10-foot Lane slow-speed amalgamation mill. The mill and mines are about 8 miles westerly from Mina. Practically all the gold ore of shipping grade came from the Sunnyside group, operated by the Priess Bros.

NYE COUNTY

The total value of metals produced in Nye County in 1931 increased from $1,464,855 in 1930 to $1,589,629 in 1931. The quantity of all five metals increased, but the value of silver, lead, and zinc decreased. The output of ore was 129,996 tons (1,611 tons more than in 1930), of which 72,138 tons were concentrated, 53,361 tons treated in gold and silver mills (mostly by cyanidation), and 4,497 tons shipped to smelters.

Athens district.—The entire output of gold ore from the Warrior mine was shipped to smelters, but no report concerning the grade of the ore or the development of the property was received from the operating company.

Bullfrog district (*Beatty*).—Five lode mines in the Bullfrog district produced 932 tons of ore yielding $4,106 in gold and 621 ounces of silver, valued together at $4,286, or $4.60 in metals a ton. Most of the ore was treated in gold and silver mills by amalgamation and gravity concentration. Ten tons of gold concentrate and 77 tons of siliceous gold ore were shipped to smelters. The producing mines were the Original Bullfrog, Consolidated Mayflower, and Gibraltar and the property of the Rhyolite Consolidated Mining Co. The Beatty Gold Mines & Milling Co., developing the Gold Ace mine 8 miles south of Beatty near Carrara, considered the purchase of a Kuenzel furnace to treat its ore.

Clifford district.—The Western Gold (Inc.), owner of the Clifford mine 35 miles east of Tonopah, turned its property over to lessees who hauled 252 tons of siliceous gold ore to Tonopah; 190 tons of the ore were shipped to smelters and 62 tons were sold to the custom cyanidation plant at Millers.

Cloverdale district (*Golden*).—Placer ground in the Cloverdale district was prospected by 36 shafts sunk to water level in gravel 30 to 50 feet deep, without reaching bedrock. This project, covering 1,760 acres and comprising the whole of Cloverdale Canyon 48 miles northwest of Tonopah, is expected to be developed further with dragline equipment to handle 5,000 cubic yards of gravel daily. Some of the equipment, including a Diesel engine and a 150-horsepower electric hoist, was delivered to the property before the end of 1931.

Eden Creek (*Gold Belt*) *district.*—At Eden Creek 65 miles east of Tonopah the Southgold-Nevada Mines Co. produced gold from erosion material treated in a small washing plant. From $1.50 to $4 in gold to the ton was recovered, but no bullion was sold in 1931. The property, consisting of 19 mining claims, is opened by several tunnels, the longest, 550 feet.

Ellendale district.—The Ellendale mine and Broken Hill claims produced very rich siliceous gold ore in 1911, 1913, 1915, and 1918. These properties were under development by the owners, and small lots of gold ore were shipped to a smelter in 1931.

Fairplay (*Goldyke*) *district.*—A little gold was recovered by amalgamation from ore mined from the Lucky Jim and Brooklyn claims.

Fluorine district.—One car lot of ore averaging nearly an ounce of gold to the ton was shipped from the Fluorine district to a smelter. The Panama-Nevada Consolidated Mines Co., owning a group of 25 mining claims on Bare Mountain (including the Diamond Queen mine from which ore was shipped), did some development work. The north and south ends of the property are opened by 7,000 feet of tunnel and shaft work.

Johnnie district.—The Gold King mine in the Johnnie district is opened by a 70-foot vertical shaft and a 100-foot tunnel. Considerable work was done in 1931, and a little gold ore was shipped to a smelter. At the Johnnie mine concentrate from mill cleanings was shipped, and a little gold was recovered from sluicing mine-dump material. The mine is opened by a 1,100-foot incline shaft.

Longstreet district.—The Crown Reef Consolidated Gold Mining Co. was organized late in 1931 to work the Longstreet mine, from which a little gold bullion was shipped.

Manhattan district.—Twenty lode mines and five operators of placers in the Manhattan district produced 4,241 tons of ore, $74,706 in gold, and 1,290 ounces of silver, valued together at $75,080. The ore had an average value of $17.37 in metals a ton; the placer output was valued at $1,394. Over half of the total output of ore was of shipping grade, most of which came from the White Caps mine, worked by lessees. A lessee worked the Amalgamated property of the Nevada Coalition Gold Mines Co. and treated the ore by amalgamation in the War Eagle custom mill. No report was received from the Gold Metal Consolidated Mining Co., which operated the Sullivan mine and produced a little gold ore of milling grade; several small lots of high-grade ore also were hauled to Tonopah for shipment to a smelter. Other producing quartz properties were the Crescent, Dexter, Durant, Big Sam of the Jumbo Mining Co., Stray Dog and Jumping Jack, Manhattan Gold, and Verden. Placers belonging to the Kirchen-Cole interests employed 12 men a short time doing assessment work on 27 placer claims.

Round Mountain district.—Three lode mines and three placers in the Round Mountain district produced 39,375 tons of ore, $394,498 in gold, and 49,696 ounces of silver, valued together at $408,910. The ore had an average value of $9.76 in metals a ton; the placer output was valued at $24,766. The increase of $205,751 in total value of district output in 1931 was due chiefly to uninterrupted operation of mills at lode mines in spite of decreased production from placers because of shortage of water.

The Gold Hill Development Co. opened up its property by an additional 1,000 feet of drifting and deepened its incline shaft to the 500-foot level. Considerable difficulty was experienced with water at this level, but the cyanidation plant was operated continuously although the thermometer in December was at times below zero. According to the annual report of the company [12] the ore milled during the year amounted to 35,652 dry tons assaying 0.38 ounce of gold and 2.49 ounces of silver (or $8.56 in metals) to the ton. The total metal content of the ore was 13,551.49 ounces of gold and 88,737 ounces of silver. Ore treated by cyanidation yielded 92.43 percent of the gold and 53.37 percent of the silver, or 89.37 percent of the total value. Bullion recovered contained 12,525.92 ounces of gold and 47,360 ounces of silver. The average mining cost per ton of ore milled was divided as follows: Stoping, $3.759; development, 19.2 cents; and shaft sinking, 9 cents. The milling cost per ton was $2.742; sorting, 15.5 cents; marketing, 4.3 cents; and residues, 9.1 cents. After these deductions were made from the total value ($8.561) per ton of ore the net profit was 67.1 cents a ton and the total operating profit $23,892.47. The company report states:

> Roughly speaking, there is developed and in sight sufficient ore to insure operations at full capacity for several months. It is hoped that development work now in process will further add to the ore reserves.

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[12] Gold Hill Development Co. Second Ann. Rept., for year ended Dec. 31, 1931.

The Nevada Porphyry Gold Mines, Inc., employed about 50 men and operated its lode mines and Sunnyside 20-stamp amalgamation mill and the 6-stamp Merrill mill at Fairview. The gold output from the placers of the company decreased due to shortage of water.

Silver Bow district.—Forty-seven tons of ore containing 7.58 ounces of gold and 4,303 ounces of silver were mined from the Single Jack claim near the Nye-Esmeralda County line in the northern part of the Silver Bow district.

Tolicha (*Monte Cristo*) *district.*—The Landmark property produced siliceous gold ore, averaging 1.75 ounces of gold and 2 ounces of silver to the ton, from an irregular surface enrichment in rhyolite. The ore was hauled 32 miles to the Tonopah & Tidewater Railroad at Beatty for shipment to the cyanidation plant at Millers, Nev., and to the smelter at Midvale, Utah.

Tonopah district.—Three lode mines in the Tonopah district on the Nye County side and one on the Esmeralda County side produced 16,534 tons of ore yielding $198,081 in gold and 823,872 ounces of silver, valued together at $437,004, or $26.43 in metals a ton. This output consisted of 15,022 tons of gold-silver ore treated by cyanidation and 1,512 tons of gold-silver ore shipped to smelters. The value of the output from this region in 1930 was $1,149,848. The total output of the district is given in the following table:

Mine production of gold, silver, copper, and lead in the Tonopah district, Esmeralda and Nye Counties, Nev., 1901–31 [1]

Period	Ore	Gold	Silver	Copper	Lead	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	
1901–10	1,359,321	$10,681,687	49,443,336	2,726	8,390	$38,856,109
1911–20	4,588,552	18,679,537	84,254,831	3,448	10,625	75,867,500
1921–30	2,287,933	7,281,421	33,356,493	164	389	32,501,331
1931	16,534	198,081	823,872			437,004
Total, 1901–31	8,252,340	36,840,726	167,878,532	6,338	19,404	[2] 147,661,944

[1] J. E. Spurr in U.S. Geol. Survey Prof. Paper 42, Geology of the Tonopah district, Nev., p. 26, 1905, records 2 tons of ore, netting about $600, produced in 1900; he gives no details as to metals.

[2] Dividends paid by 9 companies to end of 1931 totaled $37,023,224.

The Belmont mine was operated entirely by the leasing system, which engaged fully 50 lessees. No record of development work by lessees is available. The mine is opened by two vertical shafts—one 1,718 and the other 1,127 feet deep—and 247,996 feet of drifts, crosscuts, raises, and winzes. The company supplied the operating equipment to the lessees who hoisted 3,536 tons of ore, all of which, except 253 tons shipped to smelters, was treated at Millers by cyanidation. The Tonopah Extension mine and mill operations ended with the year 1930, but accumulated ore and mill material were treated in the Extension mill during part of January 1931, and some ore was treated at the Millers plant. According to the annual report of The Tonopah Mining Co.[13] its custom mill at Millers was operated at a profit. The ore (7,095 tons) mined by the company was treated at the cyanidation plant and yielded bullion containing 4,937 ounces of gold and 396,798 ounces of silver; the refractory ore, of which lessees produced 893 tons, was shipped to a smelter and yielded 601 ounces of gold and 41,235 ounces of silver. The company, purchased 4,483 tons of custom ore. Future operation of the mine and mill depends on the price of silver and the ability of the company's lessees to produce sufficient ore.

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[13] The Tonopah Mining Co. of Nevada Ann. Rept. for year ended Dec. 31, 1931.

Tybo district.—According to its annual report [14] the Treadwell Yukon Co., Ltd., produced from its property in the Tybo district 72,138 tons of mill ore assaying 0.027 ounce of gold and 11.75 ounces of silver to the ton, 7.09 percent lead, and 5.27 percent zinc. Metal recoveries were 47 percent of the gold, 74.5 percent of the silver, 83.8 percent of the lead, and 85 percent of the zinc. There were produced 6,232 tons of lead-silver concentrate and 6,081 tons of zinc concentrate. All the lead-silver concentrate (6,539 tons), including some from the previous year, was sold to the Selby smelter in California; it averaged 0.109 ounce of gold and 89.46 ounces of silver to the ton, 66.65 percent lead, and 3.75 percent zinc. Most of the zinc concentrate was held in stock at Tybo with similar concentrate produced in 1930; only 3,924 tons were sold in 1931 to the Sullivan electrolytic zinc plant at Silver King, Idaho, and the United States Zinc Co., at Amarillo, Tex. The zinc concentrate sold assayed 0.044 ounce of gold and 13.10 ounces of silver to the ton, 2.51 percent lead, and 49.35 percent zinc. Early in the year operations at Tybo were reduced to 50 percent of normal, and in October milling operations were discontinued entirely to stop operating loss brought about through decline of metal prices. Pending resumption of operations the shaft was sunk an additional 50 feet, a station was cut at the 1,010-foot level, and a crosscut was being driven to the vein. During the year the company did 30 feet of shaft sinking, 1,233 feet of drifting, 337 feet of crosscutting, and 837 feet of raises. The ore reserve at the end of 1931 amounted to 163,000 tons assaying 0.03 ounce of gold and 12.5 ounces of silver to the ton, 7.5 percent lead, and 5.25 percent zinc; this is a slight tonnage decrease from the reserve at the end of 1930. A Bureau of Mines circular [15] gives details on milling methods and costs of the lead-zinc concentrator at Tybo.

Union district (*Ione*).—Three lode mines in the Union district produced 21 tons of ore yielding $747 in gold and 200 ounces of silver, valued together at $805, or $38.33 in metals a ton. Six tons of the gold ore were shipped to a smelter, and 15 tons were treated by amalgamation. Lessees at the Berlin property 6 miles south of Ione were successful in opening up some rich ore, of which a small shipment was made to the smelter; the ore was found in driving a crosscut to intercept the Keystone vein. The Diana claim adjoining the Berlin property produced 15 tons of gold ore, from which gold bullion and concentrate were recovered in an Ellis mill; the concentrate was held at the mill. The property is opened by a 200-foot tunnel. At the Magmatic mine, opened by a 75-foot incline shaft, 4 tons of ore averaging 3.6 ounces of gold to the ton were shipped to a smelter.

Willow Creek (*Troy*) *district.*—A little gold bullion was produced by the Lincoln Gold Corporation operating near Nyala. Some development work was done on the Troy property, and the old waste dumps were sampled.

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[14] Treadwell Yukon Co., Ltd., Ann. Rept. for year ended Dec. 31, 1931.

[15] Blackburn, W. H., Milling Methods and Costs at the Lead-Zinc Concentrator of the Treadwell Yukon Co., Ltd., at Tybo, Nev.: Inf. Circ. 6430, Bureau of Mines, 1931, 15 pp.

PERSHING COUNTY

The value of metals produced from lode and placer mines in Pershing County decreased from $241,075 in 1930 to $140,803 in 1931. Nineteen lode mines in 1931 produced 10,007 tons of ore yielding gold, silver, copper, and lead valued at $136,978, or $13.69 in metals a ton; 22 placer mines yielded $3,812 in gold and 44 ounces of silver. The output of ore and all metals decreased.

Humboldt (Imlay) district.—Gold was recovered by the use of dry-washing machines devised by James Jensen, one of four operators working placers in Antelope Canyon. The locality is described as lying between Black Canyon and Eldorado Canyon 4 miles south of Humboldt House, a station on the Southern Pacific Railroad. Gold ore from the Chipmunk claim was shipped to a smelter.

Kennedy district.—The United Mines, Ltd., operating a property at Rileyville, produced and shipped to a smelter 24 tons of sulphide ore containing 0.54 ounce of gold and 35 ounces of silver to the ton, 16.2 percent lead, and 11.8 percent zinc. Another lot (16 tons of ore, largely oxidized) contained 0.60 ounce of gold and 75 ounces of silver to the ton and 21 percent lead. Some mill ore was developed in driving a tunnel, which is 1,500 feet long.

Placerites district.—According to newspaper items the Nevada-Montana Mining Co. treated an average of 140 cubic yards of material daily. Four water tanks with a total capacity of 145,000 gallons serve present needs for sampling the property. The gold output was not reported.

Rochester district.—The dismantled Rochester Silver mill was cleaned up by lessees who shipped gold bullion to Carson City and some concentrate to a smelter. At the Lincoln Hill mine gold ore was treated by amalgamation in the Great Western mill. At the placers of the Limerick Canyon Co. some gravel was developed, but finances did not permit full equipment for production.

Rosebud district.—Gold continued to be produced by miners working with dry-washing machines and small hand rockers. The bullion recovered was 0.893 fine in gold. The claims of the Associated Royalty Mining Co., from which some gold was produced, are said to cover 4,000 acres of ground.

Scossa district.—Production reported by operators of two lode mines in the Scossa district amounted to $3,279 in gold and 198 ounces of silver. This output was probably from rich ore discovered in 1930. According to a recent report [16] the vein on the North Star claim was developed by the Scossa brothers to a depth of 20 feet; about 18 inches of the vein on the hanging-wall side contain nodules and stringers of gold-bearing quartz, frequently of high value. The North Star claim was under development by the Dawes Gold Mines, Inc. Other properties are owned by the Scossa Gold Mines, Inc., North Star Extension Mines Co., and Scossa Gold Belt Mines Co.

Seven Troughs district (Vernon, Farrell).—Six lode mines in the Seven Troughs district produced 8,892 tons of ore yielding $121,869 in gold and 10,497 ounces of silver, valued together at $124,913, or $14.05 in metals a ton. Most of the output was that of the Seven Troughs Gold Mines Co., which closed its mine and cyanidation plant at the end of June. The mine is opened by an adit 11,900 feet long, and development work in 1931 totaled 8,435 feet. At the Seven Troughs Extension Mines Co. property the 50-ton amalgamation and gravity concentration plant was operated a short time. The bullion shipped to the San Francisco Mint ranged from 0.216 to 0.514 fine in gold and 0.453 to 0.767 fine in silver. From the Portland claims 157 tons of gold ore were reduced in the 5-foot Huntington custom mill at Mazuma. Ore from several old mine dumps was tested. A 2-ton arrastre was used to treat gold ore from the Golden Horseshoe claim.

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[16] Jones, J. C., Smith, A. M., and Stoddard, Carl, The Preliminary Survey of the Scossa Mining District, Pershing County, Nev.: Univ. Nevada Bull. 4, 1931, 13 pp.

Sierra district (*Sunshine, Chafey, Dun Glen*).—Three lode mines in the Sierra district produced 851 tons of ore yielding $4,439 in gold and 139 ounces of silver, valued together at $4,479, or $5.26 in metals a ton. Most of the gold was produced from the Black Hole and Auburn mines, each equipped with a small amalgamation mill. Placer mining yielded $156 in gold and silver. Chinese placer miners are said to have produced about $2,000,000 in gold from Auburn and Barber Canyons near Chafey, in the seventies, eighties, and nineties, and to have produced as much more from Rock Hill Canyon.[17] During 1931 some Chinese worked placers in the district.

Star district.—Some copper concentrate was shipped to a smelter as the result of tests made by the Tehama Mines Syndicate in a 20-ton pilot mill.

Willard district.—A 5-stamp amalgamation mill at the Sheepherder mine was operated on a trial run of a small lot of ore from the Half Sole and Lomar claims.

STOREY COUNTY

Production of metals by 23 lode mines in Storey County from 17,931 tons of ore and old tailings treated in 1931 was valued at $96,290, an increase of $36,199 over the county output in 1930. Except for the decreased value of silver the quantity and value of all metals increased.

Comstock district.—Twenty-three producers in the Comstock district reported 17,931 tons of ore and old tailings yielding $88,358 in gold, 26,074 ounces of silver, 1,390 pounds of copper, and 6,619 pounds of lead, valued in all at $96,290, or $5.37 in metals a ton, compared with a district output of $60,091 in 1930. The entire output in 1931, except 793 tons of first-class smelting ore, was treated in gold and silver mills. Most of the ore was from the property of the Lady Bryan Mining Co., which operated as such from September 23, 1931. The former operators of the Lady Bryan mine treated mostly waste-dump material by cyanidation in the Flowery mill. The Donovan amalgamation mill and cyanidation plant were in regular operation on Lucerne, Echo, and Silver Hill ores. The Sutro Tunnel Coalition, Inc., continued exploration work in the Middle Mines group at Virginia City and the Gold Hill group at Gold Hill. The ores from the Coalition properties were treated at the Donovan and Trimble plants nearby and the Millers cyanide plant near Tonopah. At the Comstock Home property 420 tons of ore yielded 205.96 ounces of gold and 470 ounces of silver by cyanidation. Lessees produced ore, treated by amalgamation in local custom mills, from the property of the Comstock Silver Mining Co., Spearhead Gold Mining Co., and Comstock Phoenix Mining Co. Material containing gold and silver was cleaned up from the Mexican mill, and about 3,000 tons of ore sorted from waste dumps of the Consolidated Virginia mine were treated by cyanidation in the Flowery mill.

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[17] Lincoln, F. C., Mining Districts and Mineral Resources of Nevada: 1923, p. 217.

WASHOE COUNTY

Nine lode mines and two placers in Washoe County yielded gold and silver valued at $9,452, or $1,454 more than 11 lode mines yielded in 1930. Lode mines produced 548 tons of ore yielding $15.25 in gold and silver a ton, and placers yielded $1,086 in gold and 36 ounces of silver.

Steamboat Springs district.—The Commonwealth mine, 13 miles south of Reno, owned by the Washoe Consolidated Mining & Milling Co., was held under option by the Treadwell Yukon Co., Ltd., but no work was done during 1931.[18] The Union lode covers the old Commonwealth mine, once a large producer of high-grade silver-lead ore. Zinc ore was opened in the lower tunnel and in winzes 100 to 150 feet deep, now partly filled with water.

White Horse district.—Six producers in the White Horse district reported 440 tons of ore yielding $6,816 in gold and 110 ounces of silver, valued together at $6,848, or $15.56 in metals a ton. Lessees produced all the ore, most of which came from the Dondero, Renegade, Renegade Extension, and Texas No. 2 mines and was treated by amalgamation in the Springfield custom 15-ton Huntington mill.

WHITE PINE COUNTY

The value of the mine production of metals in White Pine County in 1931 was $7,578,891 less than in 1930, but the total exceeded the combined output of all the other counties in the State. Both quantity and value of each metal decreased. Most of the output was low-grade milling ore reduced at McGill. Placers, chiefly at Osceola, yielded $3,534 in gold and 32 ounces of silver.

Cherry Creek district (Gold Canyon, Egan Canyon).—Demand for siliceous flux at the smelter of the Nevada Consolidated Copper Co. at McGill caused the Cherry Creek district to become second in importance to the Robinson district as a producer of such material. Most of the ore and tailings, including a little concentrate recovered from experimental flotation tests in a 50-ton mill on the property, came from the Nevada Standard. Development work consisted in driving the first 600 feet of an adit to drain the mine workings of this property. A recent report[19] describes the geology and ore deposits of the Cherry Creek district.

Osceola district.—Five placer operations and two lode mines in the Osceola district reported 18 tons of ore, $6,604 in gold, and 67 ounces of silver, valued together at $6,623. More than half the gold was reported from placer operations, much from unknown sources. The Stalwart and Home placers were producers of a little gold.

Robinson district (Ely, Lane City, Kimberly).—Eleven producers in the Robinson district reported 2,945,270 tons of ore in 1931, compared with 3,999,077 tons reported by eight producers in 1930. Most of the ore was from the Nevada Consolidated Copper Co. and the Consolidated Coppermines Corporation and from lessees on property of both companies. The district continued as the largest producer of gold and copper in Nevada; its output is indicated in the following table.

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[18] Treadwell Yukon Co., Ltd., Ann. Rept. for year ended Dec. 31, 1931.

[19] Schrader, F. C., Spruce Mountain District, Elko County, and Cherry Creek (Egan Canyon) District, White Pine County: Univ. Nevada Bull. 7, 1931, 39 pp.

Mine production of gold, silver, copper, lead, and zinc in the Robinson district, White Pine County, Nev., 1930 and 1931, and total, 1908 [1]–31

Period	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1930	8	3, 999, 077	$1, 041, 668	159, 366	105, 385, 006	59, 668	----------	$14, 806, 059
1931	11	2, 945, 270	768, 578	164, 871	71, 333, 607	----------	----------	7, 307, 749
Total, 1908 [1]–31	-------	77, 092, 952	14, 634, 117	2, 525, 174	1, 736, 203, 872	5, 011, 391	6, 070, 025	298, 216, 803

[1] Year corrected.

According to the annual report of the Nevada Consolidated Copper Co.[20] its Nevada, Arizona, and New Mexico mines were restricted in output of metal in an effort to prevent a further accumulation of unsold copper. Production at the beginning of 1931 was below 40 percent of the proved capacity of the properties and at the end of the year was below 30 percent of such capacity. Cost per pound of copper before depreciation was 8.13 cents compared with 9.59 cents for 1930. This reduction in cost was on a producing schedule of roughly one-third capacity. Unsold copper was valued at 10.50 cents a pound at the beginning of the year and 6.70 cents at the end. Corresponding adjustments in metal inventory value were carried into current production accounts. The Nevada unit of the Nevada Consolidated Copper Co. produced and treated at its reduction works 2,237,841 dry tons of company ore from its shovel pit and underground mines; in addition, 661,574 dry tons of contract and custom ores from other mines were reduced at the McGill works. Milling cost, exclusive of depreciation and taxes but including all other expenses, was 44.26 cents a ton. Cost of power-shovel mining, exclusive of depreciation and taxes but including all other expenses, was 26.56 cents a ton. Cost of mining underground milling ores from the Ruth mine was 74.8 cents a ton. A detailed review of improvements and developments during the year is given in the company annual report. Dividends distributed to stockholders in 1931 by the Nevada Consolidated Copper Co., for its Nevada, Arizona, and New Mexico properties combined, amounted to $3,885,798.40; the total paid from earnings of the three properties to the end of 1931 has amounted to $148,742,228.65. The Nevada Northern Railway (standard-gage) connects the producing mines with McGill, 26 miles distant, to which the ore is conveyed for milling and smelting. The net loss of the railway company, after tax accruals and all necessary charges for depreciation of equipment and other property were deducted, was $218,970.36; dividends aggregating $240,000 were paid out of earned surplus and are included in the income of the owner, the Nevada Consolidated Copper Co.

The mines of the Consolidated Coppermines Corporation [21] produced 15,075,605 pounds of copper, 8,140.86 ounces of gold, and

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[20] Nevada Consolidated Copper Co. Ann. Rept. for year ended Dec. 31, 1931.

[21] Consolidated Coppermines Corporation Ann. Rept. for year ended Dec. 31, 1931.

18,617 ounces of silver in 1931 compared with 32,612,203 pounds of copper, 13,917.59 ounces of gold, and 32,157 ounces of silver in 1930. All the ore produced was shipped to the mill and smelter of the Nevada Consolidated Copper Co. at McGill. The company report states:

> Concentrating ores were shipped from the Emma Nevada mine only. Production from this mine, which had been curtailed in November 1930, was further reduced June 1 and October 1, 1931, to meet copper market conditions and to conserve ore reserves during unfavorable metal prices.
>
> A small tonnage of direct smelting oxide ore, which was produced from development headings and stope maintenance, was shipped from the Alpha mine.

The annual report also includes a review of improvements, developments, costs, and rates of production during the year.

Considerable activity was aroused at several old producing mines by demand for flux at the Nevada Consolidated smelter, which handled 23,175 tons of siliceous gold ore averaging $4.38 in gold and 3.84 ounces of silver to the ton and 0.11 percent copper. Most of the ore was produced by the Ely Gold Mining Co. from the Revenue mine, opened by a 215-foot vertical shaft and 5,000 feet of drifts. The Cuba Consolidated Co., operating the Alta and Black Beauty claims in the Robinson district, was the second largest shipper of siliceous gold ore in the district; the company also owns the Cuba lead mine in the Granite district, but this mine did not produce in 1931. Lessees produced siliceous gold ore from the Los Angeles and Saxton claims, under development by the Consolidated Coppermines Corporation, and from the Jupiter property of the Nevada Consolidated Copper Co. These siliceous ores were mined from a mineralized area lying mostly in the Joana limestone and traversing a zone about 4 miles long and 60 to 120 feet wide. The properties in this mineralized area are mentioned in a report [22] of the United States Geological Survey.

White Pine district (*Hamilton*).—Two lode mines in the White Pine district produced 1,426 tons of ore and old tailings yielding $20 in gold, 2,698 ounces of silver, 137 pounds of copper, and 28,074 pounds of lead, valued in all at $1,853, or $1.30 in metals a ton. The ore (26 tons) was first-class smelting ore from the Rocco Homestake. The old tailings (1,400 tons), all from the Treasure Hill mine dump, were treated by cyanidation.

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[22] Spencer, A. C., The Geology and Ore Deposits of Ely, Nev.: U.S.Geol. Survey Bull. 96, 1917, 189 pp.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN CALIFORNIA [1]

(MINE REPORT)

By V. C. HEIKES [2]

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SUMMARY

The output of gold, silver, copper, lead, and zinc from California mines in 1931 was valued at $12,387,734, a decrease of 10 percent from the State total in 1930 and the lowest annual value recorded since 1889. This low value was due partly to the low average prices of the base metals. Compared with 1930 the total value of each metal except gold and zinc decreased, with the largest loss in value of copper; the zinc output in 1931 was small and was the first recorded since 1927.

California maintained its lead as the chief gold-producing State, with an output of over half a million ounces. Gold, lead, and zinc increased in quantity; silver and copper decreased substantially. Lode mines yielded gold, silver, copper, lead, and zinc valued at $8,363,156, a decrease of $1,677,844 from 1930; placer mines yielded gold and silver valued at $4,024,578 ($264,574 more than in 1930). Nevada County, with a recorded value of $3,374,940, chiefly in lode gold, led in total value of output. It was followed by Sacramento with $1,872,251, mostly in dredge gold; Amador with $1,553,856, chiefly in lode gold; Plumas with $1,535,222, chiefly in copper; and Yuba with $992,946, largely in dredge gold.

The total value of the gold, silver, copper, lead, and zinc produced from California ores and gravels from 1848 to 1931, inclusive, is recorded by the Bureau of Mines as $2,132,904,185. Details of production follow: Gold, $1,852,354,387; silver, 85,404,568 ounces, valued at $71,141,303; copper, 1,130,210,289 pounds, valued at $186,353,353; lead, 230,718,692 pounds, valued at $13,737,047; and zinc, 102,527,005 pounds, valued at $9,318,095.

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[1] Work on manuscript completed November 1932.

[2] H. M. Gaylord, of the Bureau of Mines, prepared the statistics for this report.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–31

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064	1930	$0.385	$0.130	$0.050	$0.048
1928	.585	.144	.058	.061	1931	.290	.091	.037	.038
1929	.533	.176	.063	.066					

Mine production of gold, silver, copper, lead, and zinc in California, 1927–31, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1927	318	465	1,526,410	564,585.50	$11,671,018	1,620,242	$918,677
1928	287	460	1,702,541	521,739.59	10,785,315	1,478,771	865,081
1929	324	478	1,657,069	412,479.25	8,526,703	1,176,895	627,285
1930	481	892	1,595,150	457,199.98	9,451,162	1,622,803	624,779
1931	462	497	1,497,247	523,135.09	10,814,162	867,818	251,667

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1927	27,133,008	$3,554,424	2,718,014	$171,235	8,062,625	$516,008	$16,831,362
1928	25,150,743	3,621,707	1,891,037	109,680	------------	------------	15,381,783
1929	33,218,994	5,846,543	1,429,489	90,058	------------	------------	15,090,589
1930	27,285,272	3,547,085	3,559,564	177,978	------------	------------	13,801,004
1931	12,931,995	1,176,812	3,757,256	139,018	159,865	6,075	12,387,734

Gold and silver produced at placer mines in California, 1927–31

Year	Dredge				Drift			
	Gold		Silver		Gold		Silver	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
1927	264,220.81	$5,461,929	18,530	$10,507	6,865.82	$141,929	835	$473
1928	214,345.43	4,430,913	14,510	8,488	7,420.05	153,386	799	467
1929	173,630.38	3,589,259	11,510	6,135	4,095.82	84,668	450	240
1930	166,980.85	3,451,801	10,753	4,140	3,029.01	62,615	426	164
1931	175,086.28	3,619,355	10,602	3,075	5,379.26	111,199	687	199

Gold and silver produced at placer mines in California, 1927–31—Continued

Year	Hydraulic				Surface				Total value
	Gold		Silver		Gold		Silver		
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	
1927	5,845.25	$120,832	700	$397	5,448.14	$112,623	838	$475	$5,849,165
1928	4,426.90	91,512	538	315	8,456.80	174,818	1,364	798	4,860,697
1929	2,889.55	59,732	445	237	6,624.85	136,948	907	483	3,877,702
1930	4,324.88	89,403	466	179	7,320.31	151,324	981	378	3,760,004
1931	3,026.16	62,556	380	110	11,011.90	227,636	1,545	448	4,024,578

GOLD

The mine production of gold in California in 1931 was $10,814,162, an increase of $1,363,000 over 1930. Of the total, lode mines yielded $6,793,416 (63 percent) and placer mines $4,020,746 (37 percent), increases of $1,097,397 and $265,603, respectively. Nevada, Sacramento, and Amador were the only counties with an output of more than a million dollars in gold. Nevada and Amador Counties led in lode gold; Sacramento County led in placer gold, with an output recovered almost entirely by dredges, and was followed by Yuba County, with an output recovered largely by dredges.

Twenty-two dredges in 1931 recovered $3,619,355 (90 percent) of the total placer gold compared with $3,451,801 (92 percent) recovered by 24 dredges in 1930. The quantity of gravel dug by dredges in 1931 was 44,423,652 cubic yards (42,724,316 in 1930), and the average recovery in gold and silver was 8.15 cents a yard compared with 8.09 cents in 1930. The total recorded production of gold by dredges since the beginning of the industry (on the Feather River) has been $170,625,099, of which the Feather River field has yielded $33,489,995, the Yuba River field $66,141,511, and the American River field $42,709,173.

Lode mining yielded 1,497,247 tons of ore, old tailings, etc., compared with 1,595,150 tons in 1930. Siliceous (gold, silver, and gold and silver) ores, old tailings, etc., sold or treated in 1931 yielded 95 percent of the total gold from lode mines; copper ore, etc., 4 percent; and lead ore and copper-lead-zinc ore, 1 percent. Amalgamation mills in 1931 recovered 65 percent of the lode-gold output, cyanidation plants 16 percent, and smelters 19 percent. The ore amalgamated (619,485 tons) averaged $7.12 in gold and 0.07 ounce of silver recovered to the ton.

Thirty properties in 1931 produced more than 1,000 ounces of gold each and contributed over 90 percent of the total output of the State. Of these properties 2 produced over 50,000 ounces each and 7 between 20,000 and 50,000 ounces each. Nine companies operated dredges on 10 of the properties, 18 operated lode gold mines, 1 a copper mine, and 1 a drift placer. The 10 largest gold-producing properties in California in 1931, in order of output, were the Empire Star Mines Co., Ltd. (gold lode), Natomas Co. (6 dredges), Yuba Consolidated Gold Fields (Yuba County) (3 dredges), Kennedy Mining & Milling Co. (gold lode), Idaho Maryland Mines Co. (gold lode), Capital Dredging Co. (3 dredges), Original Sixteen to One Mines, Inc. (gold lode), American Foundation Co. (Murchie mine) (gold lode), Argonaut Mining Co. (gold lode), and The Mountain Copper Co., Ltd. (gold lode).

SILVER

The mine production of silver in California in 1931 was 867,818 fine ounces, valued at $251,667, a decrease of 754,985 ounces in quantity and $373,112 in value from 1930. The average price of silver dropped from 38.5 cents an ounce in 1930 to 29 cents in 1931. Plumas County, with an output of over 320,000 ounces from copper ore, led in production of silver; it was followed by Nevada, Inyo, and San Bernardino Counties, each with an output of over 110,000 ounces. Only 4,182 tons of silver ore were mined in the State in 1931; it averaged 26.45 ounces of silver to the ton. Siliceous (gold, silver, and gold and silver) ores, old tailings, etc., yielded 44 percent of the total silver from lode mines, copper ore 38 percent, lead ore 16 percent, and copper-lead-zinc ore 2 percent. Concentrates yielded 69 percent of the total lode silver, first-class smelting ore 24 percent, and bullion recovered at gold and silver mills by amalgamation and cyanidation 7 percent.

Twenty-four properties in 1931 yielded more than 1,000 ounces of silver each and contributed over 97 percent of the total output of the State; no property produced as much as 500,000 ounces and only three produced over 100,000 ounces each.

COPPER

The mine production of copper in California was lower in 1931 than in any year since 1896, except 1897, 1920, and 1921, when it was only slightly less. The output in 1931 was 12,931,995 pounds, valued at $1,176,812, a decrease of 14,353,277 pounds in quantity and $2,370,273 in value from 1930, due to lower prices for the metal and consequent cessation in mining of copper ore by two of the leading copper-producing companies in the State; one of these began mining gossan for its gold content. Practically all the copper produced came from copper ore mined by a company in Plumas County; the next largest output came from Shasta County from copper-bearing pyrites roasted for the manufacture of sulphuric acid. Copper concentrate recovered from 432,294 tons of copper ore totaled 25,510 tons and yielded an average of 0.53 ounce of gold and 12.63 ounces of silver to the ton of concentrate and 24.41 percent copper. The total copper ore (473,389 tons) produced in the State in 1931 had an average assay content of 0.03 ounce of gold and 0.68 ounce of silver to the ton and 1.39 percent copper.

LEAD

The mine production of lead in California in 1931 was 3,757,256 pounds, valued at $139,018, an increase of 197,692 pounds in quantity but a decrease of $38,960 in value from 1930. Practically all the lead came from operations at the Estelle and Cerro Gordo properties in Inyo County, which have been producing lead-silver bearing ores over a long period of years; the ore from these mines, now operated as one unit, was shipped to the Selby smelter. The remainder of the lead output came from lead-copper-zinc ore mined in Nevada County; gold ores mined in Calaveras, Mono, Nevada, and Placer Counties; and lead ore mined in Kern, Los Angeles, Riverside, and San Bernardino Counties. The 5,536 tons of lead ore produced in 1931 had an average assay content of 0.25 ounce of gold and 25.59 ounces of silver to the ton, 0.11 percent copper, and 33.79 percent lead.

ZINC

The zinc recovered in California in 1931 was from a complex ore mined and milled at the Spanish mine in Nevada County.

Mine production of gold, silver, copper, lead, and zinc in California in 1931, by counties, in terms of recovered metals

County	Gold					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Alpine	0.76	$16	----------	----------	0.76	$16
Amador	68,955.66	1,425,440	5,980.73	$123,633	74,936.39	1,549,073
Butte	932.23	19,271	7,406.79	153,112	8,339.02	172,383
Calaveras	4,219.95	87,234	3,170.37	65,537	7,390.32	152,771
Del Norte	----------	----------	66.37	1,372	66.37	1,372
Eldorado	2,988.26	61,773	1,139.20	23,549	4,127.46	85,322
Fresno	45.39	938	269.64	5,574	315.03	6,512
Humboldt	9.19	190	120.38	2,488	129.57	2,678
Imperial	9.40	194	22.00	455	31.40	649
Inyo	1,957.57	40,467	6.59	136	1,964.16	40,603
Kern	9,650.32	199,490	126.63	2,618	9,776.95	202,108
Lassen	11.67	241	----------	----------	11.67	241
Los Angeles	27.29	564	35.22	728	62.51	1,292
Madera	41.20	852	75.14	1,553	116.34	2,405
Mariposa	4,243.52	87,721	42.52	879	4,286.04	88,600
Merced	----------	----------	8,395.53	173,551	8,395.53	173,551
Modoc	14.18	293	----------	----------	14.18	293
Mono	6,003.24	124,098	60.19	1,244	6,063.43	125,342
Monterey	7.17	148	----------	----------	7.17	148
Napa	714.32	14,766	----------	----------	714.32	14,766
Nevada	158,775.92	3,282,190	1,094.48	22,625	159,870.40	3,304,815
Placer	1,330.49	27,504	2,172.28	44,905	3,502.77	72,409
Plumas	13,934.09	288,043	986.84	20,400	14,920.93	308,443
Riverside	122.10	2,524	----------	----------	122.10	2,524
Sacramento	66.33	1,371	90,452.71	1,869,824	90,519.04	1,871,195
San Bernardino	2,478.10	51,227	167.95	3,472	2,646.05	54,699
San Diego	169.98	3,514	22.94	474	192.92	3,988
San Luis Obispo	----------	----------	74.92	1,549	74.92	1,549
Santa Barbara	3.92	81	----------	----------	3.92	81
Shasta	15,287.76	316,026	732.35	15,139	16,020.11	331,165
Sierra	29,954.08	619,206	1,584.20	32,748	31,538.28	651,954
Siskiyou	1,195.21	24,707	2,400.32	49,619	3,595.53	74,326
Stanislaus	----------	----------	7,471.18	154,443	7,471.18	154,443
Trinity	1,282.07	26,503	12,844.91	265,528	14,126.98	292,031
Tulare	11.79	244	----------	----------	11.79	244
Tuolumne	3,695.42	76,391	73.11	1,511	3,768.53	77,902
Ventura	14.18	293	----------	----------	14.18	293
Yuba	478.73	9,896	47,508.11	982,080	47,986.84	991,976
	328,631.49	6,793,416	194,503.60	4,020,746	523,135.09	10,814,162
Total, 1930	275,544.93	5,696,019	181,655.05	3,755,143	457,199.98	9,451,162

Mine production of gold, silver, copper, lead, and zinc in California in 1931, by counties, in terms of recovered metals—Continued

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Alpine	44	$13			44	$13
Amador	15,858	4,599	636	$184	16,494	4,783
Butte	1,572	456	668	194	2,240	650
Calaveras	3,108	901	302	88	3,410	989
Del Norte			4	1	4	1
Eldorado	801	232	175	51	976	283
Fresno	7	2	46	13	53	15
Humboldt	4	1	14	4	18	5
Imperial	3	1	5	1	8	2
Inyo	142,452	41,311			142,452	41,311
Kern	8,703	2,524	36	10	8,739	2,534
Lassen	6	2			6	2
Los Angeles	214	62	8	2	222	64
Madera	21	6	17	5	38	11
Mariposa	1,893	549	8	2	1,901	551
Merced			778	226	778	226
Modoc	6	2			6	2
Mono	18,515	5,369	9	3	18,524	5,372
Monterey						
Napa	60,009	17,403			60,009	17,403
Nevada	150,242	43,570	142	41	150,384	43,611
Placer	646	187	289	84	935	271
Plumas	322,215	93,442	102	30	322,317	93,472
Riverside	44	13			44	13
Sacramento	48	14	3,593	1,042	3,641	1,056
San Bernardino	111,890	32,448	18	5	111,908	32,453
San Diego	45	13	6	2	51	15
San Luis Obispo			2	1	2	1
Santa Barbara	6	2			6	2
Shasta	9,573	2,776	139	40	9,712	2,816
Sierra	5,510	1,598	218	63	5,728	1,661
Siskiyou	196	57	387	112	583	169
Stanislaus			768	223	768	223
Trinity	322	93	1,513	439	1,835	532
Tulare	6	2			6	2
Tuolumne	614	178	8	2	622	180
Ventura	9	3			9	3
Yuba	22	6	3,323	964	3,345	970
	854,604	247,835	13,214	3,832	867,818	251,667
Total, 1930	1,610,177	619,918	12,626	4,861	1,622,803	624,779

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Alpine							$29
Amador							1,553,856
Butte	876	$80					173,113
Calaveras	174	16	4,376	$162			153,938
Del Norte							1,373
Eldorado							85,605
Fresno							6,527
Humboldt							2,683
Imperial							651
Inyo	8,504	774	3,529,022	130,574			213,262
Kern	200	18	6,293	233			204,893
Lassen							243
Los Angeles			2,228	82			1,438
Madera							2,416
Mariposa							89,151
Merced							173,777
Modoc							295
Mono			137	5			130,719
Monterey							148
Napa	1,945	177					32,346
Nevada	143,890	13,094	198,512	7,345	159,865	$6,075	3,374,940
Placer			171	6			72,686
Plumas	12,453,926	1,133,307					1,535,222
Riverside	332	30	1,932	71			2,638
Sacramento							1,872,251

Mine production of gold, silver, copper, lead, and zinc in California in 1931, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
San Bernardino	5, 698	$519	14, 585	$540			$88, 211
San Diego							4, 003
San Luis Obispo							1, 550
Santa Barbara	7, 135	649					732
Shasta	309, 315	28, 148					362, 129
Sierra							653, 615
Siskiyou							74, 495
Stanislaus							154, 666
Trinity							292, 563
Tulare							246
Tuolumne							78, 082
Ventura							296
Yuba							992, 946
	12, 931, 995	1, 176, 812	3, 757, 256	139, 018	159, 865	$6, 075	12, 387, 734
Total, 1930	27, 285, 272	3, 547, 085	3, 559, 564	177, 978			13, 801, 004

MINING INDUSTRY

In 38 counties of California the mining industry in 1931 was stimulated by the mining of gold ore and the treatment of placer or surface material. In 26 of the counties the production of metal increased; but declining prices, particularly for copper and silver, resulted in the curtailment and subsequent closing of several producing mines in Calaveras, Plumas, San Bernardino, Shasta, Siskiyou, and Trinity Counties. Prospecting was particularly active, as many unemployed individuals worked over old placer bars abandoned for years.

Ore treated and gold and silver recovered at gold mills in Mother Lode counties in California in 1931 [1]

County	Ore treated	Gold and silver recovered in bullion			Concentrates produced [3]	Gold and silver recovered from concentrates			Value of total recovery	
		Gold	Silver	Average value per ton of ore [2]		Gold	Silver	Average value per ton of concentrates	Total	Average value per ton of ore
	Short tons	*Fine ounces*	*Fine ounces*		*Short tons*	*Fine ounces*	*Fine ounces*			
Amador	214, 504	55, 314. 16	11, 720	$5. 35	3, 692	13, 371. 50	4, 043	$75. 19	$1, 424, 429	$6. 64
Calaveras	17, 596	2, 735. 93	1, 232	3. 23	418	1, 163. 59	1, 040	58. 27	81, 270	4. 62
Eldorado	10, 055	2, 451. 39	578	5. 06	266	533. 09	221	41. 67	61, 927	6. 16
Mariposa	9, 196	3, 920. 13	1, 136	8. 85	51	165. 55	207	68. 27	84, 847	9. 23
Tuolumne	2, 760	3, 460. 89	566	25. 98	2	9. 35	11	98. 00	71, 903	26. 05
	254, 111	67, 882. 50	15, 232	5. 54	4, 429	15, 243. 08	5, 522	71. 51	1, 724, 376	6. 79
Total, 1930	261, 538	74, 340. 75	14, 896	5. 90	4, 568	17, 332. 71	4, 917	78. 85	1, 902, 687	7. 27

[1] Old tailings, etc., excluded.

[2] Average value includes some gold from pocket mining in each county.

[3] Includes only concentrates recovered from gold ore.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in California in 1931, with content in terms of recovered metals

Source	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	[1] 999,709	311,024.33	202,937	78,095	43,561	
Dry silver ore	4,182	867.97	110,621	2,650		
Dry gold and silver ore	4,520	714.32	60,009	1,945		
Copper ore	[2] 473,389	13,607.47	322,148	[3] 12,770,376		
Lead ore	5,536	1,381.74	141,691	8,264	3,554,060	
Copper-lead-zinc ore	9,911	1,035.66	17,198	70,665	159,635	159,865
Total, lode mines	1,497,247	328,631.49	854,604	[3] 12,931,995	3,757,256	159,865
Total, placers		194,503.60	13,214			
	1,497,247	523,135.09	867,818	[3] 12,931,995	3,757,256	159,865
Total, 1930	1,595,150	457,199.98	1,622,803	[4] 27,285,272	3,559,564	

[1] Includes 20,035 tons of old tailings cyanided and 2 tons of mill cleanings smelted.
[2] Includes 41,053 tons of pyrites roasted for the manufacture of sulphuric acid—residue leached.
[3] Includes 45,798 pounds of copper from mine water.
[4] Includes 242,240 pounds of copper from mine water.

Value of metals from ore, old tailings, etc., sold or treated in California in 1931, by classes of ore

Class	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons						
Dry gold ore	999,709	$6,429,444	$58,852	$7,107	$1,612		$6,497,015
Dry silver ore	4,182	17,943	32,080	241			50,264
Dry gold and silver ore	4,520	14,766	17,403	177			32,346
Copper ore	473,389	281,291	93,423	[1] 1,162,104			1,536,818
Lead ore	5,536	28,563	41,090	752	131,500		201,905
Copper-lead-zinc ore	9,911	21,409	4,987	6,431	5,906	$6,075	44,808
	1,497,247	6,793,416	247,835	[1] 1,176,812	139,018	6,075	8,363,156
Total, 1930	1,595,150	5,696,019	619,918	[2] 3,547,085	177,978		10,041,000

[1] Includes value ($4,168) of copper from mine water.
[2] Includes value ($31,491) of copper from mine water.

Ore, old tailings, etc., sold or treated in California in 1931, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Alpine	1	0.76	44			
Amador	[1] 218,255	68,955.66	15,858			
Butte	5,006	932.23	1,572	876		
Calaveras	18,068	4,219.95	3,108	174	4,376	
Eldorado	10,056	2,988.26	801			
Fresno	41	45.39	7			
Humboldt	3	9.19	4			
Imperial	18	9.40	3			
Inyo	1,740	644.06	446	409		
Kern	[2] 45,089	9,595.99	8,535	200		
Lassen	460	11.67	6			
Los Angeles	26	27.29	19			
Madera	80	41.20	21			
Mariposa	9,501	4,243.52	1,893			
Modoc	250	14.18	6			
Mono	109,839	6,003.24	18,515		137	
Monterey		7.17				

[1] Includes 3,735 tons of old tailings cyanided.
[2] Includes 16,200 tons of old tailings cyanided.

Ore, old tailings, etc., sold or treated in California in 1931, by counties, with content in terms of recovered metals—Continued

DRY GOLD ORE—Continued

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Nevada	322,599	157,740.26	133,044	73,225	38,877	
Placer	1,670	1,330.49	646		171	
Plumas	1,100	330.54	82			
Riverside	199	118.52	34	332		
Sacramento	72	66.33	48			
San Bernardino	[3] 1,844	1,599.81	1,957	2,879		
San Diego	790	169.98	45			
Shasta	197,578	15,287.76	9,564			
Sierra	47,952	29,954.08	5,510			
Siskiyou	2,055	1,195.21	196			
Trinity	[4] 2,180	1,282.07	322			
Tulare	8	11.79	6			
Tuolumne	[4] 2,777	3,695.42	614			
Ventura	20	14.18	9			
Yuba	432	478.73	22			
	999,709	311,024.33	202,937	78,095	43,561	
Total, 1930	704,001	247,856.71	101,441	20,923	17,925	

DRY SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Inyo	1	0.72	1,007			
San Bernardino	4,181	867.25	109,614	2,650		
	4,182	867.97	110,621	2,650		
Total, 1930	26,711	3,718.49	721,559	9,257	464	

DRY GOLD AND SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Napa	4,520	714.32	60,009	1,945		
	4,520	714.32	60,009	1,945		
Total, 1930	(5)					

COPPER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Plumas	432,294	13,603.55	322,133	12,453,926		
Santa Barbara	18	3.92	6	7,135		
Shasta	[6] 41,077		9	[7] 309,315		
	473,389	13,607.47	322,148	[7] 12,770,376		
Total, 1930	857,786	23,473.31	670,398	[8] 27,249,516	69,239	

LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Inyo	5,406	1,312.79	140,999	8,095	3,529,022	
Kern	70	54.33	168		6,293	
Los Angeles	15		195		2,228	
Riverside	3	3.58	10		1,932	
San Bernardino	42	11.04	319	169	14,585	
	5,536	1,381.74	141,691	8,264	3,554,060	
Total, 1930	6,652	496.42	116,779	5,576	3,471,936	

COPPER-LEAD-ZINC ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Nevada	9,911	1,035.66	17,198	70,665	159,635	159,865
	9,911	1,035.66	17,198	70,665	159,635	159,865
Total, 1930	(5)					

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[3] Includes 100 tons of old tailings cyanided.

[4] Includes 1 ton of mill cleanings smelted.

[5] None produced in 1930.

[6] Includes 41,053 tons of pyrites roasted for the manufacture of sulphuric acid—residue leached.

[7] Includes 45,798 pounds of copper from mine water.

[8] Includes 242,240 pounds of copper from mine water.

METALLURGIC INDUSTRY

Forty percent of the total ore, old tailings, etc., from California mines in 1931 were concentrated, 41 percent were treated by amalgamation, and 15 percent were treated by cyanidation. The quantity of ore shipped crude to smelters and miscellaneous material treated was negligible. The ore of smelting grade and most of the concentrates were marketed at the Selby smelter in California and at plants in Tacoma, Wash.; Hayden and Superior, Ariz.; Garfield, Midvale, Murray, and Tooele, Utah; and Silver King, Idaho. Custom milling plants receiving ores and concentrates were the Amador Metals Reduction Co. in Amador County and the Tropico plant in Kern County and other mills near Randsburg.

Nevada County, for the first time, was credited with recovery and marketing of zinc. The Spanish mine in the Washington camp produced ore yielding four products by selective flotation. Interest in the application of flotation to gold ores increased, and installations replacing vanner and table concentration were noted in Amador and Nevada Counties. Stamp milling and amalgamation were used generally throughout California, but only 14 of the many mills in operation handled over 100 tons of ore daily. Very indifferent reports from the majority of mill operators indicated that the plants were active for short periods only, some because of lack of water and others because of insufficient ore. Consumption of cyanide in California in 1931 totaled 222,309 pounds, of which 80,255 pounds were potassium cyanide, 112,602 pounds sodium cyanide, and 29,452 pounds cyanamid. In reply to the inquiry concerning the quantity of mercury (quicksilver) purchased in 1931 gold producers operating placers and lode mines reported 18,912 pounds purchased and 15,085 pounds in stock at the close of the year.

Mine production of metals in California in 1931, by methods of recovery

Method of recovery	Material treated (dry weight)	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	619,485	213,514.08	45,750			
Ore and old tailings cyanided	228,359	18,884.57	14,056			
Concentrates cyanided [1]	7,809	34,539.62	27,744			
Ore smelted	[2] 7,693	5,222.43	201,078	22,484	3,545,847	
Concentrates smelted:						
Flotation	28,633	43,694.76	555,330	12,600,301	190,330	159,865
Table and vanner	2,170	12,776.03	10,646	1,168	21,079	
Pyrites roasted for acid—residue leached	[3] 41,053			[4] 308,042		
Total, lode mines		328,631.49	854,604	[4] 12,931,995	3,757,256	159,865
Total, placers		194,503.60	13,214			
		523,135.09	867,818	[4] 12,931,995	3,757,256	159,865
Total, 1930		457,199.98	1,622,803	[5] 27,285,272	3,559,564	

[1] Concentrates cyanided came from 343,348 tons of ore first amalgamated or cyanided.
[2] Includes 2 tons of mill cleanings yielding 6.49 ounces of gold and 1 ounce of silver.
[3] Residue leached amounted to 29,335 tons.
[4] Includes 45,798 pounds of copper from mine water.
[5] Includes 242,240 pounds of copper from mine water.

Mine production of metals from gold and silver mills in California in 1931, by counties, in terms of recovered metals

County	Ore, old tailings, etc., treated		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings, etc.	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Amador	214, 504	3, 735	55, 314. 16	11, 720	110. 68	23
Butte	5, 006		135. 65	30	511. 70	488
Calaveras	17, 596		2, 663. 80	1, 169	72. 13	63
Eldorado	10, 055		2, 451. 39	578		
Fresno	30		26. 72	3		
Humboldt	3		9. 19	4		
Imperial	18		9. 40	3		
Inyo	1, 589		194. 82	86	239. 70	30
Kern	28, 654	16, 200	7, 032. 34	3, 030	2, 221. 49	3, 681
Lassen	460		5. 79	2	5. 88	4
Los Angeles	26		27. 29	19		
Madera	80		41. 20	21		
Mariposa	9, 196		3, 920. 13	1, 136		
Modoc	250		14. 18	6		
Mono	7, 614		3, 826. 67	3, 643	127. 21	168
Monterey			7. 17			
Nevada	274, 985		99, 235. 12	15, 867		
Placer	1, 626		1, 248. 74	179		
Plumas	1, 069		305. 92	65		
Riverside	148		69. 12	22		
San Bernardino	1, 328	100	1, 188. 12	1, 649	95. 68	54
San Diego	790		131. 47	34		
Shasta	197, 578		476. 72	105	14, 811. 04	9, 459
Sierra	47, 945		29, 607. 31	5, 398		
Siskiyou	2, 055		1, 195. 21	196		
Trinity	1, 989		896. 81	201	206. 44	69
Tulare	3		8. 46	4		
Tuolumne	2, 760		3, 425. 48	565	35. 41	1
Ventura	20		14. 18	9		
Yuba	432		31. 52	6	447. 21	16
	827, 809	20, 035	213, 514. 08	45, 750	18, 884. 57	14, 056
Total, 1930	654, 164	13, 869	183, 615. 59	44, 125	9, 577. 28	6, 034

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amador	3, 692	13, 371. 50	4, 043		
Butte	30	284. 88	1, 054	876	
Calaveras	418	1, 163. 59	1, 040		
Eldorado	266	533. 09	221		
Mariposa	51	165. 55	207		
Nevada	5, 540	33, 411. 99	33, 725		8, 182
Plumas	1	2. 63	1		
San Diego	14	38. 51	11		
Sierra	48	330. 10	103		
Trinity	14	134. 14	23		
Tuolumne	2	9. 35	11		
	10, 076	49, 445. 33	40, 439	876	8, 182
Total, 1930	8, 160	42, 289. 47	16, 185	353	5, 032

Mine production of metals from concentrating mills in California in 1931, by counties, in terms of recovered metals

County	Ore and old tailings treated [1]	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Calaveras	440	186	269.78	799	174	4,376	----------
Kern	95	15	81.20	190	----------	6,293	----------
Los Angeles	15	2	----------	195	----------	2,228	----------
Mariposa	260	13	40.77	472	----------	----------	----------
Mono	102,189	101	2,002.98	14,654	----------	----------	----------
Napa	4,520	131	714.32	60,009	1,945	----------	----------
Nevada	57,184	2,289	24,336.07	99,924	143,890	190,330	159,865
Plumas	432,294	25,510	13,603.55	322,133	12,453,926	----------	----------
San Bernardino	3,480	280	489.89	54,881	658	----------	----------
Trinity	180	9	26.52	24	----------	----------	----------
	600,657	28,536	41,565.08	553,281	12,600,593	203,227	159,865
Total, 1930	[1] 846,118	54,121	30,762.19	948,052	24,151,209	74,104	----------

[1] Includes 5,500 tons of old tailings concentrated in 1930 yielding 50 tons of concentrates carrying 141.10 ounces of gold and 47 ounces of silver. No old tailings concentrated in 1931.

Gross metal content of California concentrates produced in 1931, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	12,270	75,617.31	141,419	115,824	73,290	----------
Dry silver	260	464.13	54,881	692	----------	----------
Dry gold and silver	131	714.32	60,009	2,779	----------	----------
Copper	25,510	13,603.55	322,133	12,839,134	----------	----------
Lead	110	176.66	1,874	6,211	108,906	----------
Zinc	153	386.37	12,140	4,985	16,736	162,016
Copper-lead	178	48.07	1,264	56,115	39,250	----------
	38,612	91,010.41	593,720	13,025,740	238,182	162,016
Total, 1930	62,281	73,051.66	964,237	24,909,335	83,913	----------

Mine production of metals from California concentrates in 1931, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amador	3,692	13,371.50	4,043	----------	----------	----------
Butte	30	284.88	1,054	876	----------	----------
Calaveras	604	1,433.37	1,839	174	4,376	----------
Eldorado	266	533.09	221	----------	----------	----------
Kern	15	81.20	190	----------	6,293	----------
Los Angeles	2	----------	195	----------	2,228	----------
Mariposa	64	206.32	679	----------	----------	----------
Mono	101	2,002.98	14,654	----------	----------	----------
Napa	131	714.32	60,009	1,945	----------	----------
Nevada	7,829	57,748.06	133,649	143,890	198,512	159,865
Plumas	25,511	13,606.18	322,134	12,453,926	----------	----------
San Bernardino	280	489.89	54,881	658	----------	----------
San Diego	14	38.51	11	----------	----------	----------
Sierra	48	330.10	103	----------	----------	----------
Trinity	23	160.66	47	----------	----------	----------
Tuolumne	2	9.35	11	----------	----------	----------
	38,612	91,010.41	593,720	12,601,469	211,409	159,865
Total, 1930	62,281	73,051.66	964,237	24,151,562	79,136	----------

Mine production of metals from California concentrates in 1931, in terms of recovered metals—Continued

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	12, 270	75, 617. 31	141, 419	82, 049	69, 627	
Dry silver	260	464. 13	54, 881	658		
Dry gold and silver	131	714. 32	60, 009	1, 945		
Copper	25, 510	13, 603. 55	322, 133	12, 453, 926		
Lead	110	176. 66	1, 874	4, 969	103, 458	
Zinc	153	386. 37	12, 140	3, 490	16, 736	159, 865
Copper-lead	178	48. 07	1, 264	54, 432	21, 588	
	38, 612	91, 010. 41	593, 720	12, 601, 469	211, 409	159, 865

Gross metal content of California crude ore shipped to smelters in 1931, by classes of ore

Class of ore	Ore	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry gold	1, 396	3, 480. 77	3, 994	4, 046	378
Dry silver	802	403. 84	55, 740	2, 096	
Copper	42	3. 92	15	8, 668	
Lead	5, 451	1, 327. 41	141, 328	11, 811	3, 732, 012
	7, 691	5, 215. 94	201, 077	26, 621	3, 732, 390
Total, 1930	28, 804	4, 183. 82	396, 441	1, 783, 597	3, 592, 580

Mine production of metals from California crude ore shipped to smelters in 1931, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Alpine	1	0. 76	44		
Amador	16	159. 32	72		
Calaveras	32	50. 65	37		
Eldorado	1	3. 78	2		
Fresno	11	18. 67	4		
Inyo	5, 558	1, 523. 05	142, 336	8, 504	3, 529, 022
Kern	210	315. 29	1, 802	200	
Mariposa	45	117. 07	78		
Mono	36	46. 38	50		137
Nevada	341	1, 792. 74	726		
Placer	44	81. 75	467		171
Plumas	31	21. 99	16		
Riverside	54	52. 98	22	332	1, 932
Sacramento	72	66. 33	48		
San Bernardino	1, 159	704. 41	55, 306	5, 040	14, 585
Santa Barbara	18	3. 92	6	7, 135	
Shasta	24		9	1, 273	
Sierra	7	16. 67	9		
Trinity	10	13. 93	4		
Tulare	5	3. 33	2		
Tuolumne	16	222. 92	37		
	7, 691	5, 215. 94	201, 077	22, 484	3, 545, 847
Total, 1930	28, 804	4, 183. 82	396, 441	1, 726, 807	3, 412, 843

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead
Dry gold	1, 396	3, 480. 77	3, 994	3, 820	308
Dry silver	802	403. 84	55, 740	1, 992	
Copper	42	3. 92	15	8, 408	
Lead	5, 451	1, 327. 41	141, 328	8, 264	3, 545, 539
	7, 691	5, 215. 94	201, 077	22, 484	3, 545, 847

REVIEW BY COUNTIES AND DISTRICTS

ALPINE COUNTY

The Colossus Mining Co. developed its lode mines in the Mogul and Monitor district and produced a test lot of gold ore containing a little silver; the ore was hauled to Minden, Nev., for shipment by rail to a smelter.

AMADOR COUNTY

The value of the metals produced in Amador County decreased from $1,847,291 in 1930 to $1,553,856 in 1931, due to smaller output of gold and silver and corresponding decrease in ore from the Sutter Creek mines.

Jackson and Sutter Creek districts.—Fourteen lode mines and prospects near Jackson, Martell, Plymouth, and Sutter Creek produced 217,601 tons of ore and old tailings yielding $1,417,125 in gold and 15,731 ounces of silver, valued together at $1,421,687, or $6.53 to the ton. Three mines furnished the principal part of the metal output. Of the total ore produced 213,859 tons were treated by amalgamation, concentration, and cyanidation; 2,953 tons of sulphide concentrates were reground and treated with current sands and slimes in a custom cyanidation plant. Only 3 tons of gold ore and 739 tons of concentrates were shipped to a smelter. At one property a lessee treated 3,735 tons of old tailings by cyanidation in a leaching plant. The Argonaut Mining Co., Ltd., operated its 60-stamp amalgamation-gravity concentration mill 323 days and did 4,760 feet of development, chiefly in drifts and crosscuts. Gold bullion was shipped to a smelter and iron sulphide concentrate treated with current sands and slimes at the adjoining cyanidation plant of the Amador Metals Reduction Co. At the Kennedy mine experiments with flotation were begun on ore in June at the 60-stamp amalgamation-gravity concentration mill. A 2-cell Kraut flotation machine was installed to take the feed of a 5-stamp battery. The tests brought the vanner tailing containing about $2 a ton in gold down to about 30 cents. A new hoist was installed at the shaft which was 4,950 feet deep at the close of the year. Development of the Central Eureka Mining Co. property was confined to the Old Eureka mine on the 2,000, 2,100, and 2,300 foot levels. The ore mined, containing a little iron pyrites and arsenopyrite, was milled in a 150-ton stamp amalgamation-gravity concentration plant. Gold bullion was shipped to a smelter; concentrate was treated at a local custom plant by cyanidation. Nearly 4,000 tons of tailings from the Eureka mine were sand-pumped to a 100-ton experimental leaching plant, classified, mixed with coal tar, and distributed in vats with 1 percent percolating cyanide solution. The Merrill-Crowe process was used to precipitate the gold. Mining operations at the Central Eureka property were described at length in a circular [3] published in 1931. The Amador Queen No. 2 and Fuller claims yielded gold (mostly 0.840 fine) from pocket mining.

Lancha Plana district.—The Lancha Plana Gold Dredging Co. produced 6,148.21 ounces of fine gold and 642 ounces of silver in 1931 compared with 7,985.09 ounces of gold and 888 ounces of silver in 1930. An electrically driven dredge equipped with 85 buckets, each of 6 cubic feet capacity, handled 3,500 cubic feet of material daily. According to the annual report of the company [4] the dredge was digging in ground to an average depth of 35 feet during 357 calendar days of dredging time and handled 762,371 cubic yards of material at an operating cost of $75,850.33, an average cost of 9.949 cents a yard. The recovered gold and silver, valued at $127,276.37, averaged 16.695 cents to the yard. The net operating profit was $51,635.41 (6.773 cents a yard). In 1930 the company handled 731,637 cubic yards of material dug from an average depth of 21.8 feet and recovered $166,258.69 in metals, an average yield of 22.724 cents to the yard at a cost of 12.846 cents. Over 13 acres were dredged in 1931 compared with about 21 acres in 1930.

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[3] Spiers, James, Mining Methods and Costs at the Central-Eureka Mine, Amador County, Calif.: Inf. Circ. 6512, Bureau of Mines, 1931, 12 pp.

Middle Bar district.—Small placers in the Middle Bar district produced $2,656 in gold and 14 ounces of silver, chiefly from Dry Creek, Mule Creek, and Sutter Creek.

Oleta district.—Storekeepers at Oleta purchased placer gold recovered locally and near Silver Lake.

Pioneer (Pine Grove, Volcano) district.—While gold-bearing ore deposits at Pine Grove and Volcano were being developed a little gold ore was produced from the Carrie, Coeur Leonis, Golden Thread, Happy Thought, Haverly, Levezzo Ranch, and New Pines lode mines. The Elephant placer and prospects near Volcano produced $1,700 in gold and silver.

BUTTE COUNTY

The value of the metals produced in Butte County increased from $127,326 in 1930 to $173,113 in 1931. Drift and surface placers chiefly along West Branch and Middle Fork of the Feather River contributed largely to the total gold. Many small lots of gold were received at the San Francisco Mint from Cherokee, Enterprise, Honcut, Magalia, Merrimac, Stirling, and Yankee Hill and from Slate, Little Butte, and Big Butte Creeks. Near Oroville the Shasta Butte Gold Dredging Co. operated a dredge on an ancient river channel at Haselbusch and produced gold and some platinum metals. Near Magalia the Cory (Princess) drift mine produced gold; the Genii Mining Co. did not operate its property in 1931 but disposed of the gold produced in 1930. Seven lode mines produced 5,006 tons of ore yielding $19,271 in gold, 1,572 ounces of silver, and 876 pounds of copper, valued in all at $19,807, or $3.96 in metals a ton. Most of the ore was of milling grade and came from the Las Plumas mine in the Mount Diablo or Yankee Hill region 30 miles north of Oroville. Mill products consisted of gold bullion recovered by cyanidation and some sulphide concentrate, containing gold, silver, and a little copper, shipped to a smelter.

CALAVERAS COUNTY

The value of the metals produced in Calaveras County decreased from $355,961 in 1930 to $153,938 in 1931, due chiefly to cessation in mining of copper ore at Copperopolis.

Angels district.—Three lode mines and six placers in the Angels district produced 102 tons of ore, $38,540 in gold, and 218 ounces of silver, valued together at $38,603. The Calaveras Central drift placer was the largest producer; the mine is opened by a shaft and drifts and is equipped with a surface mill. About 10,000 tons of material were handled between June and the end of the year. The Vallecito Mining Co. produced bullion from its gold deposit in the ancient stream bed known as the Tertiary Calaveras. Details of the history of drift mining and of the Vallecito Western mine are given in a Bureau of Mines circular.[5] The Demarest and Whittle lode mines, both equipped with amalgamation mills, were active.

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[4] Lancha Plana Gold Dredging Co. Ann. Rept. for year ended Dec. 31, 1931.

Camanche district.—Four placers in the Camanche district yielded $11,987 in gold and 37 ounces of silver. The Gold-Gravel Products, Inc., operating on ground near Wallace was the largest producer. The company used a 1¼-yard Link-Belt gas shovel in handling 45,520 cubic yards of gravel. A small lot of gold was produced from the Gold Hill claims 2 miles east of Camanche.

Jenny Lind and Felix districts.—Three lode mines and one dredge in the Felix section of the Jenny Lind district produced 14,430 tons of ore, $65,730 in gold, and 1,892 ounces of silver, valued together at $66,279. The leading producer was the Royal lode mine, 11 miles northeast of Milton, equipped with a 120-stamp amalgamation-gravity concentration and flotation plant. Experiments were made with the mill product after it left the concentrating tables, but results were not reported. The placer output was from a dredge operated on South Gulch by the Milton Mining Co.

Mokelumne Hill district.—Four placers in the Mokelumne Hill district produced $1,900 in gold and 14 ounces of silver. Most of the gold was from drift mines in Old Woman's and Chili Gulches.

Westpoint district.—Eight lode mines in the Westpoint district produced 1,016 tons of ore yielding $10,455 in gold, 886 ounces of silver, 174 pounds of copper, and 4,376 pounds of lead. The Black Wonder mine was the largest producer of metals in the district, followed by the Woodhouse, Sledge Hammer, Wickham, and Yellow Aster.

DEL NORTE COUNTY

The value of the gold and silver produced in Del Norte County increased from $280 in 1930 to $1,373 in 1931. Most of the output was from placers near French Hill and Myrtle Creek in the Smith River Basin district. Many prospectors tried various methods of concentration on the beach sands; the most successful used burlap-covered tables. The French Hill hydraulic mine was the largest producer in the county, but water shortage hampered operations.

ELDORADO COUNTY

The value of the metals produced in Eldorado County increased from $78,269 in 1930 to $85,605 in 1931, chiefly in placer gold. The ore mined increased from 9,216 to 10,056 tons, due largely to new developments on the Mother Lode traversing the county north and south and other districts east and west.

Grizzly Flat (Mount Pleasant) district.—Five lode mines in the Grizzly Flat district produced 629 tons of ore yielding $5,929 in gold and 140 ounces of silver. Most of the district output was from the Middle End (Sciaroni) mine, operated part of the year by the Pal-O-Mine Mining & Milling Co., Ltd., the Spondulix, Mount Pleasant, and Campini properties. Small lots of placer bullion recovered in the district were reported by banks and bullion buyers.

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[5] Steffa, Don, Gold Mining and Milling Methods and Costs at the Vallecito Western Drift Mine, Angels Camp, Calif.: Inf. Circ. 6612, Bureau of Mines, 1932, 13 pp.

Mother Lode region.—Twenty-three lode mines and prospects in the Mother Lode region, which traverses the entire length of Eldorado County, produced 8,972 tons of ore yielding $49,836 in gold and 631 ounces of silver, or $5.58 in metals to the ton. The output was entirely siliceous ore treated by amalgamation. The ore (7,893 tons) treated at four stamp mills equipped for amalgamation and gravity concentration yielded 254 tons of concentrates containing 464.06 ounces of gold and 182 ounces of silver. Most of the metal output was from mines 1 to 4 miles north of Placerville. The Guilford (Poverty Point) mine, operated by the Golden Horseshoe Mining Corporation, Ltd., was the chief producer of gold bullion and concentrate; about 4,000 feet of work were necessary to open 3 of the 4 tunnels which had caved, and repairs were also made in the 50-ton mill equipped with 10 stamps and 2 Wilfley tables. The Kelsey Mining Co., Inc., produced gold bullion and iron concentrate during tests in a 10-stamp pilot mill. The Van Hooker mine was opened further by 870 feet of tunnel and crosscuts; the ore was treated in a 10-stamp amalgamation-gravity concentration mill. Near Garden Valley the Sliger mine produced gold bullion and concentrate; the mine is opened with a 500-foot vertical shaft. Very little development work was done in 1931 by the Sliger Gold Mining Co., and the 30-stamp amalgamation-gravity concentration mill operated only 60 days due to water shortage. The Veercamp Ranch and Rymal lode mines produced a little gold. In the region of Coloma, Kelsey, Greenwood, Georgetown, and Spanish Dry Diggings are numerous pocket and seam mines. The Georgia Slide mines, producers in 1931, come under this classification and are described by the State mineralogist[6] as "seam diggings." The gold occurs in a multitude of narrow and discontinuous stringers, which were worked by blasting and shattering the formation where seams of quartz containing free gold occur; the broken material was hydraulicked into sluices. In the southern part of the Mother Lode region the Hamburger Mines Co. was actively engaged in sampling the Martinez mine between Nashville and El Dorado and did 470 feet of development work; the property, reported as the Duncan and Adams mine, produced about 700 tons of ore and according to the operators yielded $10,266 in gold and silver recovered in a 5-stamp amalgamation mill. Probably the most important piece of development work on the Mother Lode was near Georgetown. The Beebe Gold Mining Co. developed a large deposit of $4-gold ore in the amphibolite schist to a depth of 250 feet. A reduction plant using a Hadsel impact mill with cyanidation plant was under construction in November. Ore from the Pyramid mine west of Placerville was tested in a 50-ton Vandercook mercuric cyanide mill constructed at the property in 1929.

The placers produced $22,088 in gold and 167 ounces of silver. The chief placer producing localities were American River, Badger Gulch, Chili Bar, and Weber Creek near Placerville, Dutch Creek near Georgetown, Manhattan and Irish Creeks and Scotts Ravine near Kelsey, Consumnes River near Nashville, and Martinez Creek near Diamond Springs. The largest placer operations were near Lotus on the South Fork of American River. The Great Bend Corporation, Ltd., installed a gas-operated shovel with a daily capacity of 600 cubic yards of gravel. About 60,000 cubic yards of material yielding an average of about 8 cents in gold to the yard were handled before operations were discontinued.

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[6] State Mineralogist, Twenty-second Annual Report: 1926, p. 410.

Pilot Hill district.—A small quantity of gold bullion was recovered from ore reduced in a hand mortar from the Crystal claim near Cool. Four placers yielded $1,364 in gold by sluicing.

Rescue district.—The old Boulder or Kaiser lode claim north of Rescue produced 32 ounces of gold from sorted ore.

Slate Mountain district.—Ore from mine dumps of the Ida and Edith property 20 miles northeast of Placerville was treated in a stamp mill. The property has produced gold for many years.

FRESNO COUNTY

Most of the gold produced in Fresno County in 1931 was from the commercial gravel plant of the Grant Service Rock Co. near Friant. Over a hundred individuals worked with rockers and long toms and recovered gold from material of an abandoned gravel pit near Friant on the San Joaquin River. In the Sycamore and Davis Flat districts small lots of gold were recovered by lode mining.

HUMBOLDT COUNTY

The value of the metals produced in Humboldt County increased from $2,513 in 1930 to $2,683 in 1931. About 50 ounces of gold were recovered from beach sands in the Gold Bluff district near Orick in 1931 with burlap tables and other devices. In the Orleans district hydraulic mining and sluicing of material yielded $1,513 in gold and silver. The Orcutt, Rocky Point, Rough & Ready, and Witchstick placers were under development; each produced a little gold.

IMPERIAL COUNTY

The Golden Nugget and Trio lode claims in the Potholes district 17 miles northeast of Yuma, Ariz., and the dry washing of material in the Picacho district yielded the metal output of Imperial County, which was valued at $651. The American Girl mine in the Hedges district was under examination, but no ore was produced.

INYO COUNTY

The metals produced in Inyo County were valued at $213,262 in 1931 compared with $236,817 in 1930. Most of the output came from lead ore shipped from the Cerro Gordo district. A drift placer in Mazourka Canyon near Independence was developed and produced a little gold.

Cerro Gordo district.—The Cerro Gordo and Estelle properties operated by the American Smelting & Refining Co. produced 4,409 tons of oxidized lead ore shipped to the Selby smelter. At the Santa Rosa mine a lessee produced 47 tons of oxidized lead ore averaging 31.7 percent lead.

Chloride Cliff district.—Lead ore and gold ore were hauled from the Old Mill group and Rose claims 19 miles to Beatty, Nev., for shipment to a smelter by railroad.

South Park district.—Shipments of bullion were made in 1931 from the Radcliff mine and from a prospect.

KERN COUNTY

The value of the metals produced in Kern County increased from $167,192 in 1930 to $204,893 in 1931. Most of the output was from lode mines in the Randsburg district. Placers in various parts of the county were worked by sluicing or dry washing methods and produced $2,618 in gold and 36 ounces of silver.

Agua Caliente district.—A little gold bullion from the Castle Tower, Gold Peak, and Juniper lode mines was marketed at the San Francisco Mint.

Green Mountain district.—A little mill ore from the Gold Standard mine was treated in the 15-ton gravity concentrator on the property; the concentrate and some first-class ore were shipped to a smelter.

Keyes and Pioneer districts.—Eight lode mines and prospects and an indefinite number of small placers produced 103 tons of ore, $2,415 in gold, and 65 ounces of silver. All the ore except two small lots shipped to a smelter was treated in small amalgamation mills. A storekeeper at Hobo Hot Springs bought many small lots of gold from placer miners working on Kern River.

Mojave district (*Rosamond*).—Eleven lode mines, including prospects, in the Mojave district produced 1,843 tons of ore yielding $40,763 in gold, 6,441 ounces of silver, and 6,293 pounds of lead, valued in all at $42,864, or $23.26 in metals a ton. The output consisted of many lots of ore from the Elephant, Standard, and other claims on Soledad Mountain treated by amalgamation and cyanidation in the Tropico custom mill near Rosamond.

Rademacher district.—Four lode prospects 4 miles north of Searles station produced 53 tons of gold ore, mostly of shipping grade, yielding $1,593 in gold and 94 ounces of silver. The ore (2 tons) from the Star Gold claim was treated at the Christian mill in Kelso Valley and yielded 16.97 ounces of gold and 4 ounces of silver.

Randsburg district.—Eighteen lode mines and two placers in the Randsburg district (Kern and San Bernardino Counties) produced ore and bullion in 1931. Most of the output came from mines and prospects, including placers, in the western part of the district lying in Kern County; the Kelly (Uranium) mine was the only producer reported in the eastern part of the district lying in San Bernardino County. The total output of the Randsburg district comprised 28,911 tons of gold ore (including mine-dump screenings) milled; 16,200 tons of old tailings treated by cyanidation; and 804 tons of gold ore and silver ore and 260 tons of silver concentrate shipped to smelters. During the first two months of 1931 the Wortley Consolidated Mines, Inc., produced from the Kelly mine 676 tons of silver ore which were treated by flotation; the ore yielded 79 tons of concentrate which with some crude silver ore were shipped to a smelter. The concentrate from the milling ore averaged 0.25 ounce of gold and 24.12 ounces of silver to the ton and the smelting ore averaged 0.4 ounce of gold and 39.37 ounces of silver. In September the Wortley Consolidated was succeeded by the Red Mountain Mines Syndicate; the latter company operated until the end of the year and produced bullion from gold ore which was treated in a new 200-ton cyanidation plant and silver ore which was treated in the 200-ton flotation mill. The Kelly mine is opened by a 1,500-foot vertical shaft and has 50,000 feet of drifts. Water for milling was pumped from the Kelly No. 2 and Santa Fe shafts. The largest producer in the western section of the district was the Yellow Aster mine equipped with a 50-stamp amalgamation mill and a cyanidation plant for tailings. About 23,000 tons of ore and 8,500 tons of old tailings were treated. The Shipsey Mining Co. in April started operations at the King Solomon mine and treated ore by amalgamation in a 5-stamp mill and old tailings by cyanidation in a 15-ton plant. The mine is opened by a 650-foot vertical shaft and 5,000-foot tunnel. The Butte Lode Mining Co., equipped with a 10-stamp mill and a 60-ton cyanide plant, milled 247 tons of gold ore and 1,846 tons of old tailings. About 600 tons of gold ore were milled from the Hercules claim in the Operator Consolidated amalgamation plant. The Rand Mines Co. operated the Windy mine and 30-ton rod mill and treated company ore and other ore by amalgamation. Other mines operated were the Bing Hole, Buckboard, Fremont, Holland, Josephine, and Lillian V. Some screenings from the mine dumps of the Gold Coin, Napoleon, and Stanford claims were hauled to custom mills for treatment. Placer mining on prospects in camps near Randsburg yielded $889 in gold and 7 ounces of silver. Old placers were worked at Goler Summit Diggings, in the Stringer district near Atolia, in Last Chance Canyon, and in the immediate vicinity of Randsburg. A Pierce land dredger with tractor equipment worked material near Randsburg.

LASSEN COUNTY

Hayden Hill district.—A 10-ton amalgamation mill 16 miles west of Doyle was operated a short time on gold quartz from the Twelve O'clock prospect.

LOS ANGELES COUNTY

The metals produced in Los Angeles County in 1931 were valued at $1,438. The lode output came from ore amalgamated and from a small shipment of concentrate, containing silver and lead, from Catalina Island. Many small lots of gold were produced by numerous prospectors washing gravel near Azusa in San Gabriel Canyon and near Saugus in San Francisquito Canyon.

MADERA COUNTY

The value of the metals produced in Madera County increased from $1,395 in 1930 to $2,416 in 1931. Many prospectors working placer ground along Chowchilla Creek and Fresno River, chiefly in the Potter Ridge district, recovered gold. Two lode mines near Hildreth produced gold by amalgamation; the Hanover mine, the chief producer, is opened by a 300-foot tunnel and recovered gold in a 6-foot Huntington mill.

MARIPOSA COUNTY

The value of the metals produced in Mariposa County increased from $59,787 in 1930 to $89,151 in 1931. Merchants reported many small lots of placer gold taken from Bear, Black, Boneyard, Buckhorn, Maxwell, Sherlock, and Stockton Creeks and from Arkansas Flat and Dogtown Diggings.

Bagby, Coulterville, and Hite Cove districts.—Twenty lode mines and placer prospects produced 7,034 tons of ore, $76,873 in gold, and 1,733 ounces of silver, valued together at $77,376. The ore, of which most was free milling, averaged $10.92 in gold and silver to the ton. The Original Ferguson Mining Co. at Clearinghouse produced 5,083 tons of ore yielding gold bullion and concentrate recovered in its 10-stamp amalgamation-gravity concentration mill. A new discovery of ore similar to that mined on the upper levels was made on the 1,225-foot level of the Original mine. The Virginia near Coulterville, Yellow Metals near Bricetown, and Feliciana at Hites Cove were important gold producers. Some placer gold from Maxwell and Sherlock Creeks was purchased by merchants at Coulterville and Bagby.

Hunter Valley district.—Seven lode mines in the Hunter Valley district produced 626 tons of ore (including tailings from the School House mine and a mill clean-up) yielding $2,349 in gold and 26 ounces of silver, valued together at $2,357, or $3.77 to the ton. Most of the ore was from the Live Oak, Hunter Valley, and Brownie mines.

Mount Bullion, Colorado, and Whitlock districts.—Ten lode mines in the Mount Bullion, Colorado, and Whitlock districts produced 1,841 tons of ore and screenings yielding $9,090 in gold and 140 ounces of silver, valued together at $9,131, or $4.96 to the ton. The Belmont Metals Corporation operated the Colorado mine and 10-stamp Hendy mill and shipped gold bullion and gold concentrate. The Princeton mine dumps near Mount Bullion were worked by lessees who continue each year to mill screenings in a plant equipped with a gyratory crusher, an amalgamation plate, and a table concentrator. A little gold bullion was recovered from Lonesome Pine ore treated in a 5-stamp mill.

MERCED COUNTY

The metals produced in Merced County were valued at $173,777 in 1931, or $85,303 more than in 1930. The Yuba Consolidated Gold Fields operated the La Grange dredge 1½ miles west of Merced Falls and handled 1,805,669 cubic yards of material. A new dredge near Snelling was under construction by the Snelling Gold Dredging Co. Merchants in the county purchased many small lots of gold from prospectors.

MODOC COUNTY

The gold and silver produced in Modoc County came chiefly from the Lost Cabin lode mine 8 miles west of Ghent on the Southern Pacific Railroad. The ore was treated in a 10-ton amalgamation and oil flotation plant.

MONO COUNTY

The value of the metals produced in Mono County increased from $29,659 in 1930 to $130,719 in 1931; nearly all came from gold ore and concentrates from mines at Bodie and small placers near Bridgeport.

Bodie district.—The Treadwell Yukon Co., Ltd., continued to operate the Red Cloud and other claims in the Bodie district, mining and milling all the low-grade ore and mine-dump material available. The 20-stamp mill equipped with Union vanners operated intermittently and the 200-ton flotation plant continuously on mine-dump screenings. Underground development failed to reveal ore of economic value, and the attempt to mill the surface dump material at a profit proved disappointing. Late in 1931 the company decided definitely to abandon the property and move the machinery elsewhere.

Dogtown Diggings district.—Three placers in the Dogtown region 8 miles from Bridgeport produced $1,244 in gold and 9 ounces of silver. Two dragline excavators dumped the placer material into large hoppers; it was then fed to revolving screens and sluices. Gold 0.854 fine was recovered.

Masonic district.—The Victoria Mining Corporation operated the Chemung mine and 30-ton Hendy ball mill, with equipment for cyanidation, from May to October. Some cyanide product containing gold and silver was produced.

MONTEREY COUNTY

A little gold bullion recovered from ore treated in an arrastre on the Holly Berry (Plaskett) claim in the Los Burros district represented the metal output of Monterey County in 1931.

NAPA COUNTY

One lode mine, the Palisades (Grigsby), near Calistoga in Napa County produced gold, silver, and copper valued at $32,346. The property was operated by the Banner Development Co. until late in 1930 when the property was placed in the hands of a receiver who operated the mine and flotation mill a short time in 1931.

NEVADA COUNTY

The value of the metals produced in Nevada County increased from $2,219,896 in 1930 to $3,374,940 in 1931, due chiefly to activity at the gold-producing mines near Grass Valley.

French Corral, North San Juan, and Rough and Ready districts.—Lode and placer mining in the French Corral, North San Juan, and Rough and Ready districts yielded $10,864 in gold and 88 ounces of silver. Nearly all the gold produced was sold to the San Francisco Mint by three merchants in the districts, and no definite record of the producing mines was reported.

Grass Valley, Nevada City, and Newtown districts.—Fifteen lode mines and five placer operators produced 317,839 tons of ore, $3,241,207 in gold, 132,873 ounces of silver, 73,225 pounds of copper, and 38,877 pounds of lead, valued in all at $3,287,841. The ore averaged $10.34 in metals to the ton compared with $9.73 in 1930. The gold output continued to be larger than that of any other district in California. Many prospectors sluicing gravel in a small way along Deer Creek and Yuba River contributed to the placer gold output, which, however, decreased from $2,950 in 1930 to $1,042 in 1931. The district was credited with gold of unknown origin totaling about $37,000, an increase over 1930.

At the end of the year the Empire Star Mines Co., Ltd., acquired the Murchie property situated 5 miles from its Grass Valley property—the Empire, North Star, and Pennsylvania. According to the annual printed report[7] the company produced 214,534 tons of ore valued at

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[7] Empire Star Mines Co. (Ltd.) Ann. Rept. for year ended Dec. 31, 1931.

$2,022,736 from the Grass Valley mines. All the ore, including 24,946 tons of lessee ore, was reduced in the Empire and North Star mills by gravity-flotation concentration; the sands and slimes and the flotation concentrate were treated by cyanidation. The average recovery value of all material treated was $9.435 a ton. These figures compare with 177,803 tons of ore milled in 1930 yielding $9.442 a ton. Tonnage was increased by raising the output of the North Star mine and placing all 50 stamps of the North Star mill in commission. Flotation of the tailings obviated the necessity of reconditioning the North Star cyanide plant, the flotation concentrate being treated successfully by cyanidation at the Empire mill. Development at the Grass Valley mines of the company totaled 18,178 feet compared with 19,512 feet in 1930, and ore reserves were estimated at 267,500 tons of an average recoverable value of $9.32 a ton. Total operating costs were reduced to $7.08 a ton. An initial dividend of $1 a share was paid to stockholders in December. The operation of these mines is unique, as the remnants of ore are scattered over 3 miles of strike and 2 miles of dip on six different narrow veins. These conditions make development and maintenance costs high, and the life of the properties therefore depends on lowering them.

The Idaho Maryland, Union Hill, Morehouse, and Brunswick properties, comprising 1,211 acres covering 3 miles along the strike of the vein systems in the Grass Valley district, are controlled by the Idaho Maryland Mines Co. The annual report of the holding company[8] states that the Idaho Maryland and Brunswick mills, each with 20 stamps, were operated to the end of October and reduced 45,005 tons of siliceous gold ore yielding $574,573.33, or $12.77 in metals a ton; the average loss in tailings was $2.17. In 1930, with only one mill operating, 19,452 tons of ore yielded $241,059 and averaged a recovery of $12.40 in metals a ton and a loss of $2.04 in tailings. Flotation equipment has been added to both mills; at the Brunswick it replaced table concentration and at the Idaho Maryland the vanners. Gold bullion from the plates at both mills went to the San Francisco Mint and gold concentrates to the Selby smelter. Mine development during the year was confined to the new 1,900 or No. 3 vein and comprised 4,200 feet of drifts, crosscuts, and raises. The mine is opened by a 2,000-foot vertical shaft.

The American Foundation Co. operated the Murchie mine and 300-ton flotation mill to the end of the year, when its property was transferred to the Empire Star Mines Co., Ltd. Double the amount of ore produced the previous year was treated, with corresponding increase in gold-bearing iron concentrate shipped by auto truck to the Selby smelter. The Murchie mine is opened by a 1,300-foot 85° incline shaft. Development work in 1931 comprised 1,200 feet of drifts and 1,600 feet of raises. Changes in the mill were made by discarding the twenty 1,080-pound stamps for a set of 1,680-pound stamps.

The Federal Loan Consolidated mines on Deer Creek near the Murchie mine were reopened, and new crushing and flotation equipment was added to the old St. Louis mill on the property; a little gold ore and some concentrate were shipped to a smelter. About 700 tons of gold-bearing sulphide ore from the Queen Lil mine were treated in a 10-stamp amalgamation-gravity concentration mill on the property, and gold bullion and concentrate were produced; the mine is opened by a 236-foot incline shaft. The Hoge Development Co. produced gold ore of shipping grade during the development of its property. The Empress Mining Co., Ltd., 4 miles west of Nevada City, completed the sinking of the Newtown mine shaft to the 450 level in December and started construction of a flotation mill; the vein now averages about 3 feet in width and in places ore with some sulphides containing gold and silver is more than 20 feet in width.

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[8] Idaho Maryland Consolidated Mines (Inc.) Ann. Rept. to stockholders for year ended Dec. 1, 1931.

Washington, North Bloomfield, North Columbia, and Graniteville districts.—Eight lode mines and sixteen placers in the Washington, North Bloomfield, North Columbia, and Graniteville districts produced 14,670 tons of ore, $43,078 in gold, 17,347 ounces of silver, 70,665 pounds of copper, 159,635 pounds of lead, and 159,865 pounds of zinc, valued in all at $66,521. The ore yielded on the average $4.03 in metals a ton. The output of the region consisted of 4,759 tons of gold ore treated in four amalgamation mills and 9,911 tons of copper-lead-zinc milling ore reduced to 1,119 tons of concentrates. All the milling ore was from the Spanish mine 21 miles northeast of Nevada City in the Washington district, where a new mill was completed in April and operated until December. Development consisted of 1,043 feet of drifting in the mine, which is opened by a crosscut and haulage tunnel 5,035 feet long. This tunnel cuts a barite deposit 3,600 feet from the portal, and nearly all the development was along the barite vein. The mill equipment comprises an Allis Chalmers crusher, Hardinge ball mill, Dorr duplex classifier, 2 Wilfley tables, 26 Kraut (standard-size) cells, Oliver filter, 2 Joshua Hendy agitation tanks, Hardinge thickener, and 6 Wilfley pumps. Copper-lead concentrate, lead concentrate, zinc concentrate, and gold-bearing iron concentrate were shipped for smelting and further treatment to reduction works at Selby, Calif; Silver King, Idaho; and Tacoma, Wash. An article[9] describing the mining and milling practice at the Spanish mine appeared in October. At Graniteville the Ancho mine, with a 10-stamp amalgamation-gravity concentration mill, operated until October on siliceous gold ore containing iron and lead sulphides. About 3,000 tons of ore yielded gold bullion and 12 tons of concentrate; the bullion was shipped to the San Francisco Mint and the concentrate held at the mill. The Eagle Bird mine on the South Fork of Yuba River, opened by a shaft 350 feet deep, was further developed in April by the Eagle Bird Mine, Inc. Tests in a 10-stamp amalgamation mill on the property showed that 70 percent of the gold was recovered by amalgamation.

Placers in the region produced $7,437 in gold and 28 ounces of silver. Most of the gold was from the Omega hydraulic mine 4 miles from Washington; only 1 of the 7 giants at the property was operated, owing to lack of water. Many small lots of placer bullion were sold to merchants who failed to record the source of production.

You Bet district.—Seven placer mines in the You Bet district produced $9,417 in gold and 75 ounces of silver. At the property of the You Bet Mining Co. a portable unit equipped with dragline bucket and conveyors and sluices was installed late in the season to handle placer material.

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[9] Bradley, James ,Mining and Milling at the Spanish Mine: Min. and Met. October 1931, pp. 435–439.

PLACER COUNTY

The value of the metals produced in Placer County increased from $29,411 in 1930 to $72,686 in 1931. Most of the mining activity in the county was confined to surface and drift placers worked by prospectors along Bear River and the North Fork and Middle Fork of American River.

Foresthill district.—Two lode mines and 12 placers in the Foresthill district yielded $23,315 in gold and 156 ounces of silver. Most of the gold was from the Three Queens lode mine and from sluicing placer tailings from the Hidden Treasure property. Many small lots of bullion, chiefly from Shirt Tail Canyon near Foresthill, were sold to merchants. Developments at the Mayflower drift placer consisted of construction work on 26 miles of ditch and flume and extension of the 8,600-foot tunnel which opens the Baltimore mine; a little gold was produced.

Iowa Hill, Dutch Flat, and Gold Run districts.—One lode mine and 11 placers in the Iowa Hill region produced $14,494 in gold, 567 ounces of silver, and 171 pounds of lead. The total includes the output reported by merchants who purchased from prospectors many small lots of gold dust recovered from placer material. The Star United and Welcome Consolidated drift placers were the chief producers of gold in the region.

Last Chance, Michigan Bluff, and Canada Hill districts.—One lode mine and 12 placers in the Last Chance and Michigan Bluff regions produced $15,225 in gold and 81 ounces of silver. Most of the output was from the Glenn and Baker Divide drift placers. The latter was operated the entire year by the Volcanon Mining Corporation, Ltd. About 30 tons of siliceous gold ore from the Daniel Webster mine were treated in a 2-stamp amalgamation mill.

Ophir district.—Two lode mines and nine placers in the Ophir district produced $14,923 in gold and 94 ounces of silver. The Paramount Gold Mines Corporation, Ltd., developed the Big Oak lode mine and cooperated with the owners to open the Conrad and Centennial veins. Placer bullion, chiefly from the vicinity of Auburn and from Rattlesnake Bar on American River east of Loomis, was sold to merchants.

Ralston Divide district.—The Rubicon River placer in the Ralston Divide district produced about 15 ounces of gold 0.941 fine. The region is very inaccessible and the working season short.

PLUMAS COUNTY

The value of the metals produced in Plumas County decreased from $3,108,183 in 1930 to $1,535,222 in 1931 due to the low price of copper and to idleness of a large copper producer. A decrease of 7,075,298 pounds in copper was recorded.

Butte Valley district (Belden).—Small placers and one lode mine in the Butte Valley region produced $7,540 in gold and 43 ounces of silver. Many small lots of gold dust were marketed at banks and traded by miners and prospectors to storekeepers for supplies. Most of the placering was done along the North Fork of Feather River. The gold sold to the San Francisco Mint averaged around 0.900 fine.

Genesee district.—The Walker Mining Co. continued to operate its property in the Genesee district, and although the company was active throughout the year mining was restricted and a smaller output of ore resulted. According to the annual report of the company[10] 432,294 tons of ore were treated at the flotation mill, yielding 25,342 tons of copper concentrate. The quantity of concentrate marketed, including lime scale and screenings, was 25,532 tons, which at the smelter yielded 12,850,281 pounds of copper, 322,429 ounces of silver, and 13,614.21 ounces of gold. All the output was handled over an aerial tramway connecting the mine with the Western Pacific Railroad at Spring Garden and was shipped to International, Utah. Mine development totaling 6,997 feet and costing $90,988 added more ore to the reserves. Due to the extremely low price of copper and the general business outlook the company decided early in December to limit production and rotate employment by placing the underground and surface men on a 3-day week basis. Low costs with resulting profits are expected by the company when metal prices again justify full-capacity operation. The flotation mill at the Walker mine was described in a circular[11] issued early in 1932.

Greenville district.—Five lode mines in the Greenville district produced 768 tons of ore yielding $3,445 in gold and 45 ounces of silver, valued together at $3,458, or $4.50 in metals a ton. At the Southern Eureka mine, the chief producer of gold in the district, 750 feet of development work were done. Gold ore was produced from the Wolf Creek-Evergreen-Jersey claims, 6 miles west of Greenville; machinery was installed for a reduction plant, and an air compressor was added to the mine equipment.

Lights Canyon district.—No production was reported from the Lights Canyon district, where the Engels mine was the chief metal producer in previous years. In 1931 the few men employed at the property did only necessary upkeep and maintenance work. According to the annual report of the company[12] about 138,105 tons of 1.3 percent copper ore were blocked out in the mine, and the ore left in the pillars would average about 3 percent copper. A detailed description[13] of the Superior mill of the Engels mine was published early in 1932.

RIVERSIDE COUNTY

The value of the metals produced in Riverside County decreased from $5,635 in 1930 to $2,638 in 1931. More ore was shipped to smelters in Arizona than in 1930, and less gold ore was treated in the county at amalgamation mills. The Lost Horse mine east of Banning was the chief producer of gold in the county; a 10-stamp amalgamation mill was used.

SACRAMENTO COUNTY

Sacramento was the second largest gold-producing county in the State in 1931. The value of the metals produced increased from $1,726,025 in 1930 to $1,872,251 in 1931, due to a larger yardage of material handled by dredges near Natoma.

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[10] Walker Mining Co. Ann. Rept. for year ended Dec. 31, 1931.

[11] McKenzie, M. R., and Lancaster, H. K., Milling Methods at the Concentrator of the Walker Mining Co., Walkermine, Calif.: Inf. Circ. 6555, Bureau of Mines, 1932, 11 pp.

[12] Engels Copper Mining Co. Ann. Rept. for year ended Dec. 31, 1931.

[13] Nelson, W. I., Milling Methods and Costs at the Superior Concentrator of the Engels Copper Mining Co., Plumas County, Calif.: Inf. Circ. 6550, Bureau of Mines, 1932, 22 pp.

Folsom (Natoma) district.—Nine dredges, two rock-crushing and gravel plants, small placers, and one lode mine in the foothill section of the Folsom district produced gold and silver. According to its annual printed report for 1931 the Natomas Co. operated six dredges and handled 14,922,888 cubic yards of material at a gross return per yard of 8.18 cents, a cost of 5.01 cents, and a net return of 3.17 cents. Compared with 1930 the material handled increased 21,745 yards, but gross returns from operations decreased 1.01 cents a yard due to lower ground values; the net return was 0.41 cent less than in 1930, the difference (0.60 cent) being the decrease in cost of operation. The Capital Dredging Co. operated three electrically driven dredges and handled 7,967,354 cubic yards of material. Both dredging companies produced platinum metals, besides gold and silver. Several small lots of ore averaging $16 in gold to the ton from a vein in the amphibolite schist on the Broder ranch were shipped to a smelter.

SAN BERNARDINO COUNTY

The value of the metals produced in San Bernardino County decreased from $244,610 in 1930 to $88,211 in 1931 as a result of the low price of silver. There was also a large decrease in output of ore, as the Wortley Consolidated Mines, Inc., ceased operations in the Randsburg district. Most of the placer gold was recovered by dry washing methods in the Lava Bed district near Newberry and in the Goldstone district northeast of Barstow.

Barstow district.—A dump of old tailing near Barstow left from the treatment of Bagdad Chase ore is the source annually of a little gold recovered by cyanidation. According to the owner about 50,000 tons of tailing averaging about $1.50 in gold and 1.5 ounce of silver to the ton remain in the dump.

Dale district.—Three lode mines in the Dale district produced 430 tons of ore yielding $3,987 in gold and 95 ounces of silver. Leasers at the Supply mine experimented with cyanidation of about 100 tons of ore. A small amalgamation mill was used to test ore from the Los Angeles and Brooklyn claims.

Kelso district.—Four lode mines in the Kelso district produced 134 tons of ore yielding $1,539 in gold, 10 ounces of silver, and 319 pounds of copper. Most of the ore was from the Frisco claims and was shipped to a smelter.

Lava Bed district.—The Royal claim near Daggett produced gold 0.927 fine recovered from erosion material by dry washing.

Randsburg district.—The output of the Kelly (Uranium) mine, the only mine in the eastern part of the Randsburg district lying in San Bernardino County from which production was reported for 1931, is included in the review of the district under Kern County (p. 651).

Silver Mountain district.—Three lode mines in the Silver Mountain district produced 81 tons of ore yielding $1,580 in gold, 72 ounces of silver, and 798 pounds of copper. The ore came from the Mojave Boy and Sidewinder mines and the Percival prospect; most of it was shipped direct to the smelter.

SAN DIEGO COUNTY

The value of the metals produced in San Diego County increased from $2,244 in 1930 to $4,003 in 1931 as a result of new mining activities in the Julian district.

Julian district.—Six lode mines in the Julian district produced 790 tons of ore yielding $3,514 in gold and 45 ounces of silver, and small placers produced $474 in gold and 6 ounces of silver; all the ore was treated in amalgamation mills. At the Golden Chariot mine, the largest producer in the district, operations consisted mostly of flotation tests. The owner of the Eagle mill treated ore from the Eagle mine and some custom ore.

SAN LUIS OBISPO COUNTY

The output of gold and silver credited to San Luis Obispo County in 1931 was reported to have come from placer mining in the northern part of the county in Oro Fino Gulch, tributary to San Antonio River.

SANTA BARBARA COUNTY

Eighteen tons of copper ore shipped to a smelter from the vicinity of Los Olivos in the San Rafael Mountains, Santa Barbara County, yielded $81 in gold, 6 ounces of silver, and 7,135 pounds of copper, valued in all at $732.

SHASTA COUNTY

The value of the metals produced in Shasta County decreased from $746,766 in 1930 to $362,129 in 1931 as a result of the decided decline in output of copper ore from the Iron Mountain mines. Placer or surface mining by many prospectors increased the amount of gold sold in small lots to merchants in Redding; purchases of as little as 9 cents in gold dust were made.

Clear Creek district.—Placers along Clear Creek and its tributaries, worked by many prospectors, yielded $4,918 in gold and 47 ounces of silver.

Cottonwood Creek district.—The output of small placers and one dredge in the Cottonwood district totaled $2,166 in gold and 7 ounces of silver. The dredge was moved late in 1930 to the mouth of Roaring River above Gas Point on Cottonwood Creek and has been operated intermittently since; gold and some platinum metals were recovered.

French Gulch district.—Small placers and nine lode mines in the French Gulch district produced 210 tons of ore, $10,532 in gold, and 115 ounces of silver. All the ore was free milling, and in many instances small lots of sorted ore were treated by amalgamation in hand mortars.

Iron Mountain district.—The Mountain Copper Co., Ltd., operating the Hornet and Iron Mountain mines in the Iron Mountain district, was the largest producer of metals in Shasta County. Production of copper sulphide ores was discontinued, and the gossan material overlying the copper was treated by cyanidation. The company continued to produce copper-bearing pyrites which was roasted at its smelter near Martinez for the manufacture of sulphuric acid, fertilizer, etc.; the residue of the roasted material was leached and yielded copper.

SIERRA COUNTY

The value of the metals produced in Sierra County increased from $591,305 in 1930 to $653,615 in 1931; the increase came chiefly from mines in the Alleghany district. Placers at Goodyears Bar and along Kanaka Creek produced most of the placer gold.

Alleghany (Forest) district.—Nine lode mines and ten placers, with miscellaneous prospectors and "snipers", in the Alleghany (Forest) district produced 47,416 tons of ore, $620,828 in gold, and 5,496 ounces of silver. The ore averaged $12.94 in metals a ton. The Original Sixteen to One mine, the largest producer in both district and county, was operated continuously. At the Brush Creek mine of the Kate Hardy Mining Co. the 10-stamp amalgamation mill was operated nearly full time and the No. 4 level opened up. The company also has a 5-stamp mill, idle in 1931. Various lots of high-grade bullion of undetermined origin were sold to bullion buyers and credited to the district. A geological report [14] describing the ore deposits of the Alleghany district has been issued by the United States Geological Survey.

Downieville district (Goodyears Bar).—Four lode mines and six placers in the Downieville district, with miscellaneous lots of placer bullion, yielded $18,275 in gold and 128 ounces of silver. The Kirkpatrick drift placer at Goodyears Bar mentioned under the Alleghany (Forest) district in the 1930 chapter of this series is in the Downieville district, and its production in 1931 is included in the Downieville district totals. The producing lode mines were the Finney, Oxford, Sovereign, and Triple Pocket.

Port Wine, Table Rock, Gibsonville district.—Numerous prospectors of placer property in the Table Rock and Gibsonville region produced $5,336 in gold and 24 ounces of silver. The Washington, Atlas, and Wehrle No. 1 placer claims were the principal producers in the district, but many small lots of placer gold from along Slate Creek are included in the total.

Sierra City district.—Five lode mines in the Sierra City district produced 453 tons of ore yielding $4,932 in gold and 69 ounces of silver, valued together at $4,952, or $10.93 to the ton. The producers were the Bigelow group, Four Hills, Monarch, Sacred Mound, and prospects on Howard Creek. Most of the ore was treated at amalgamation mills; one small lot was shipped to a smelter.

SISKIYOU COUNTY

The value of the metals produced in Siskiyou County decreased from $127,290 in 1930 to $74,495 in 1931, chiefly because copper-ore shipments from the Elliott Creek region ceased and gold output from placer and lode mining in the Salmon River and Scott River regions decreased.

Klamath River region.—One lode mine and many small placers in the vicinity of Happy Camp, Oak Bar, and Seiad Valley and on the Klamath River and its tributaries produced $26,671 in gold and 178 ounces of silver in 1931; the region yielded $20,004 in gold and 143 ounces of silver in 1930. The largest production of gold in 1931 was reported by the Buzzard Hill Mines, Inc., controlling the Buzzard Hill and Independence lode mines south of Happy Camp. The Bumble Bee hydraulic placer on Indian Creek was also an important producer of gold.

North Central region.—Thirteen lode mines and 13 placers produced $17,945 in gold and 152 ounces of silver in 1931; the region yielded $19,724 in gold and 150 ounces of silver in 1930. The producers include mines in the Cottonwood, Deadwood, Greenhorn, Humbug, and Oro Fino sections. Various lessees washed the gravels of McConnell Bar south of the Klamath River and west of the mouth of Humbug Creek; the bar was also worked by the owner with a dragline equipment. At the Tony Lund drift placer west of McConnell Bar and on the opposite side of the Klamath River preparations were made to handle gravel from the pit with a large slack-line drag unit. The Schroeder mine in the Deadwood district was the largest producer of ore; it was treated by amalgamation in a 10-stamp mill. The High Grade mine on Vesy Creek near Gottville produced rich gold quartz; the gold was recovered by amalgamation in a hand mortar.

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[14] Ferguson, H. G., and Gannett, R. W., Gold Quartz Veins of the Alleghany District, Calif.: U.S. Geol. Survey Prof. Paper 172, 1932, 139 pp.

Salmon River region.—Seven lode mines and 25 placers in the Salmon River region, which embraces the area around Cecilville, Forks of Salmon, Liberty, Sawyers Bar, and Somesbar, yielded $15,956 in gold and 127 ounces of silver in 1931; the region produced $19,095 in gold and 156 ounces of silver in 1930. The Malloy mine in the Liberty district was the largest producer of lode gold; the ore was treated by amalgamation in a 3-stamp mill. Placers yielded $14,077 in gold recovered chiefly by hydraulicking methods. The Summerville hydraulic property on the South Fork of Salmon River was the largest producer of gold in the region. Other producing hydraulic placers were the Gallia, Paddy Cronin, and Rainbow near Sawyers Bar, the Cosmodel and Banner near Cecilville, and the Orcutt on Methodist Creek. The Wike drift placer near Sawyers Bar was also productive.

Scott River region (Scott Bar, Callahan).—Ten lode mines and placers in the Scott River region produced $13,114 in gold and 122 ounces of silver in 1931; the region yielded $6,912 in gold and 67 ounces of silver in 1930. Small lots of lode gold sold to bullion buyers in 1931 are included in the total output. The Gum Boot lode mine, 8 miles east of Scott Bar, was the largest producer of gold in the region; recovery was made in an amalgamation mill on the property. The mine is opened by a 340-foot tunnel. Other producing lode mines were the Virginia near Callahan, the May Day on French Creek near Etna, and the Mata Pan. The Quartz Hill lode mine near Scott Bar was again hydraulicked.

STANISLAUS COUNTY

The value of the metals produced in Stanislaus County increased from $109,342 in 1930 to $154,666 in 1931. The output was derived by dredging material 5 miles west of La Grange and by small placer operators who sold their gold to merchants and bullion buyers. The gold recovered at the Atlas-Olympia and Roberts commercial rock plants at Oakdale was a byproduct in the preparation of sand and gravel for the market.

TRINITY COUNTY

The value of the metals produced in Trinity County decreased from $413,218 in 1930 to $292,563 in 1931, due chiefly to idleness at the Island Copper Co. property and to the decrease in dredge output; the Madrona dredge at Junction City closed in May.

Coffee Creek district (Carrville, Coffee).—Three lode mines and 12 placers in the Coffee Creek district, with small lots of gold dust purchased by merchants, yielded $9,671 in gold and 119 ounces of silver compared with a district output of $7,313 in gold and 89 ounces of silver in 1930. The placer output was $5,323 in gold and 46 ounces of silver. The ore (624 tons) came chiefly from the Golden Jubilee mine, which was operated throughout the year; it was treated by cyanidation and yielded on an average $7 in metals a ton. At the Wagner property of the Modoc Gold Mines, Inc., the Vandercook mercuric cyanide process was used on stope fillings. Some gold was recovered by cyanidation from ore of the Geneva mine. The Boulder, Glacier, and Junction placers at the junction of North Fork and Coffee Creek and the Golden Trinity, Holland, Prince Albert, and Schlomberg properties were important producers of gold.

Hayfork district.—Two lode mines and three placers in the Hayfork district produced $2,326 in gold and 19 ounces of silver. The Shasta Trinity Mines Co. produced a little gold by amalgamation during development of the Mueller mine 6 miles from Hayfork; a 50-ton flotation mill was under construction at the end of the year. Placer gold was produced from the Nugget Bar, Spring Valley, and Weed claims.

Helena (*East Fork, North Fork*) *district.*—One lode mine and five placers in the Helena district produced $18,191 in gold and 161 ounces of silver. The lode output came from siliceous gold ore mined at the Enterprise and treated by amalgamation in a 10-stamp mill; both mine and mill were operated by the Chiksan Oil Co. The North Fork hydraulic property was the largest producer of placer gold in the district.

Junction City and Canyon Creek districts (*Dedrick*).—One lode mine and 10 placers, with miscellaneous lots of placer bullion handled by banks and merchants, yielded $38,995 in gold and 213 ounces of silver. The Madrona dredge and the Red Hill and Oswald hydraulic placers were the largest producers in the district. The Madrona dredge closed in May.

Lewiston (*Deadwood, Minersville, Eastman Gulch*) *district.*—The total gold output of the Trinity and Lewiston dredges decreased in 1931 compared with 1930; the dredges handled over 2,236,000 cubic yards of material. The Placer Development Co., Ltd., continued to operate the Lewiston dredge purchased in 1930. The Trinity dredge about 5 miles above Lewiston operated continuously and handled nearly 1,200,000 cubic yards of material. At the Paulson ranch the Gold Bar Dredging Corporation was constructing a dredge.

New River district (*Burnt Ranch-Denny*).—Four placers in the New River district yielded $4,548 in gold and 29 ounces of silver. The bullion was recovered by hydraulicking gravels of the Trinity Loop, Keystone, Good Luck, and Wolverine placers. The gold from these placers ranged from 0.864 to 0.901 fine.

Salyer district.—Some gold and platinum metals were produced in the Salyer district from the development of placer property at the junction of the Trinity River and the South Fork of the Trinity by the Salyer Consolidated Mines Co. The company discontinued operations the last of May.

Weaverville district.—Seven placers in the Weaverville district and small lots of gold dust handled by bullion buyers yielded $7,170 in gold and 37 ounces of silver. Most of the output came from the Hook and Ladder, the Testy Race Track, and the Senger property and from numerous prospects. Purchases of gold were made by the Trinity County Bank at Weaverville.

TULARE COUNTY

The value of the metals produced in Tulare County decreased from $363 in 1930 to $246 in 1931. Bullion buyers credited prospects in the White River district with metal output the past 2 years.

TUOLUMNE COUNTY

The value of the metals produced in Tuolumne County increased from $68,598 in 1930 to $78,082 in 1931, due chiefly to rich pockets of gold opened near Columbia and Tuttletown and a larger output of gold in the New Years district in the Mother Lode belt.

Columbia (*Shaws Flat, Springfield, Bald Mountain*) *district.*—Twenty-two lode mines in the Columbia district produced 247 tons of ore yielding $32,021 in gold and 135 ounces of silver, valued together at $32,060, or $129.80 to the ton. The placer output was $112 in gold and 1 ounce of silver. Most of the lode output came from the Hidden Treasure, Sugarman, and Experimental Gulch mines. An electric hoist and compressor were installed at the Sugarman mine; the rich ore from pocket mining was reduced in a small amalgamation mill and yielded gold averaging 0.907 fine. Free gold was mined at the Ham & Birney property and the Dondero, Cardinal, Lazar, Big Bonanza, Mexican Springhill, Faxon, and Roderick claims, all pocket mines near Columbia, Bald Mountain, and Shaws Flat. Merchants purchased most of the gold from small placers; the amount is included in the district total.

East Belt district.—Seventeen lode mines in the East Belt district near Big Oak Flat, Groveland, Soulsbyville, and Tuolumne produced 1,541 tons of ore yielding $6,750 in gold and 97 ounces of silver, valued together at $6,778, or $4.40 to the ton. The Soulsby Bell mine produced most of the ore.

Goodwin Dam district.—Bench gravel of the Stanislaus River above Goodwin Dam yielded $703 in gold and 3 ounces of silver, reported by prospectors.

Mother Lode district.—Nineteen lode mines in the Mother Lode district produced 989 tons of ore yielding $37,620 in gold and 382 ounces of silver, valued together at $37,731, or $38.15 to the ton. The placer output was valued at $697 in gold and silver, chiefly reported by bullion buyers. The "55" lode mine in the New Years district near the Mariposa County line was the most important producer in the Mother Lode belt. The mine is opened by an incline shaft; about 200 feet of drifting were done in 1931. Most of the gold credited to the mines at Tuttletown was from pocket mining. The Atlas property on Jackass Hill produced chiefly pocket gold. The Jumper mine near Jamestown yielded some high-grade gold ore. This gold was recovered in small amalgamation mills.

VENTURA COUNTY

The metal output of Ventura County was $293 in gold and 9 ounces of silver in 1931 compared with $223 in gold and silver in 1930. The output in 1931 came from the Sibert lode mine in the Piru district; the ore was treated in a 5-foot Lane mill.

YUBA COUNTY

The value of the metals produced in Yuba County increased from $970,069 in 1930 to $992,946 in 1931 due to slight increases in dredge output in the Yuba River district and lode mining in the Dobbins district.

Camptonville district.—Six placers (including the Garden Valley dredge) in the Camptonville district produced $8,525 in gold and 46 ounces of silver.

Challenge-Brownsville district.—Three lode mines and numerous unemployed persons working the gravels along the Yuba River in the Challenge-Brownsville district produced $4,985 in gold and 28 ounces of silver. The Mount de Oro and Walberg mines were the chief producers.

Dobbins district.—The Red Cross Mining Co. treated 372 tons of ore by amalgamation and cyanidation; it yielded 447.21 ounces of gold and 16 ounces of silver.

Smartsville district.—The output of the Blue Point hydraulic property and many small lots of placer gold purchased by storekeepers in the Smartsville district totaled $11,689 in gold and 59 ounces of silver. The district output in 1930 was $9,604 in gold and 45 ounces of silver.

Strawberry Valley district.—Placer mining in the Strawberry Valley district yielded $2,406 in gold and 10 ounces of silver. Most of the gold was reported by storekeepers and came from prospectors washing gravels on Slate Creek. Some gold was mined in Yuba County near Scales, Sierra County.

Yuba River district (*Browns Valley, Hammonton, Marysville*).—The Yuba Consolidated Gold Fields in the Yuba River district was the third largest producer of gold in California in 1931. According to the printed annual report of the company [15] three dredges (Nos. 14, 15, and 19) were operated. The combined production of these three dredges for the fiscal year ended February 29, 1932, was $883,220.31, an increase of a little over 2.3 percent compared with the previous year. The total area dredged was 103.27 acres. The average value recovered per cubic yard was 8.07 cents after refining costs and express charges were deducted. The average cost of dredging was 4.08 cents per cubic yard and the net profit 3.99 cents. Altogether the dredges handled 10,943,277 cubic yards of material at a cost of $446,820.29, with net production valued at $883,220.31 and a profit of $436,400.02.

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[15] Yuba Consolidated Gold Fields Ann. Rept. for year ended Feb. 29, 1932.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN OREGON[1]

(MINE REPORT)

By V. C. HEIKES[2]

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SUMMARY

The value of the mine production of gold, silver, copper, and lead in Oregon in 1931 was only 2 percent less than that of gold, silver, copper, lead, and zinc in 1930. Both quantity and value of every metal except gold decreased, but the gain in gold nearly offset the loss in total value of the other metals. Copper decreased 99 percent in both quantity and value, lead 62 percent in quantity and 72 percent in value, and silver 19 percent in quantity and 39 percent in value. The 57 lode mines produced 7,092 tons of ore yielding $87,464 in gold, 5,690 ounces of silver, 1,700 pounds of copper, and 3,497 pounds of lead, valued in all at $89,398, or $12.61 in metals a ton. Placer mines yielded $229,851 in gold and 1,564 ounces of silver, valued together at $230,305.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is the average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1927–31

Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*
1927	$0.567	$0.131	$0.063	$0.064
1928	.585	.144	.058	.061
1929	.533	.176	.063	.066
1930	$0.385	$0.130	$0.050	$0.048
1931	.290	.091	.037	.038

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[1] Work on manuscript completed November 1932.

[2] H. M. Gaylord, of the Bureau of Mines, prepared the statistics for this report.

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1927–31, in terms of recovered metals

Year	Mines producing		Ore and old tailings (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1927	36	150	26,839	14,676.16	$303,383	45,830	$25,986
1928	41	90	12,676	10,931.19	225,968	30,924	18,091
1929	45	111	10,509	17,092.00	353,323	30,009	15,995
1930	47	143	8,994	14,401.34	297,702	9,000	3,465
1931	57	139	7,092	15,350.10	317,315	7,254	2,104

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1927	488,200	$63,954	5,300	$334			$393,657
1928	358,463	51,619	13,246	768			296,446
1929	655,746	115,411	20,180	1,271			486,000
1930	176,300	22,919	9,113	456	12,528	$601	325,143
1931	1,700	155	3,497	129			319,703

GOLD

The mine production of gold in Oregon in 1931 was $317,315 ($19,613 more than in 1930). Lode mines yielded 28 percent and placers 72 percent of the total gold produced, the same ratios as in 1930. The output of gold from placers increased 7 percent and that from lode mines 5 percent compared with 1930. The leading gold-producing counties in Oregon in 1931 were Jackson, Josephine, Grant, and Baker, named in order of output; these four counties produced 88 percent of the total gold yield of the State, largely in placer gold. Malheur County, with an output entirely from placers, and Douglas County, with an output largely from lode mines, were next in rank. More than 43 percent of the total gold was produced by three dredges working gravel deposits in Baker, Grant, and Jackson Counties. The Humdinger (gold lode) in Josephine County, the Mathewson (hydraulic placer) in Malheur County, the Sylvanite (lode) in Jackson County, the Continental (lode) in Douglas County, and the Columbia Placers, Inc., (hydraulic ground) in Josephine County were also important gold producers.

SILVER

The mine production of silver in Oregon in 1931 was 7,254 fine ounces, valued at $2,104, a decrease of 1,746 ounces in quantity and $1,361 in value from 1930. The output was entirely from placer bullion and gold ore, and most of it came from gold concentrates from ore mined and milled in Grant County. Lode mines produced 5,690 ounces and placer mines 1,564 ounces compared with 7,421 and 1,579 ounces, respectively, in 1930.

COPPER

The mine production of copper in Oregon in 1931 was only 1,700 pounds, valued at $155, the smallest output ever recorded for the State, and in striking contrast to the maximum recorded production of 3,581,886 pounds in 1916. The output in 1931 was almost entirely from gold ore shipped to smelters.

LEAD

The mine production of lead in Oregon in 1931 totaled 3,497 pounds, valued at $129. Most of it came from gold ore shipped to smelters, but a little was recovered from gold concentrates.

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1930 and 1931, in terms of recovered metals

County	Gold						Silver (lode and placer)	
	Lode		Placer		Total			
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Baker	688.52	$14,233	1,578.07	$32,622	2,266.59	$46,855	375	$109
Coos	--------	--------	34.63	716	34.63	716	8	2
Curry	3.98	82	67.71	1,400	71.69	1,482	10	3
Douglas	498.07	10,296	136.43	2,820	634.50	13,116	766	222
Grant	588.11	12,157	2,571.94	53,167	3,160.05	65,324	4,276	1,240
Jackson	896.61	18,535	3,687.35	76,224	4,583.96	94,759	902	262
Josephine	1,298.35	26,839	2,241.10	46,328	3,539.45	73,167	625	181
Lane	243.21	5,028	27.40	566	270.61	5,594	120	35
Linn	5.84	121	1.16	24	7.00	145	2	1
Malheur	--------	--------	768.40	15,884	768.40	15,884	166	48
Marion	--------	--------	1.24	26	1.24	26	--------	--------
Union	8.38	173	--------	--------	8.38	173	4	1
Wheeler	--------	--------	3.60	74	3.60	74	--------	--------
Total, 1931	4,231.07	87,464	11,119.03	229,851	15,350.10	317,315	7,254	2,104
Total, 1930	4,028.80	83,283	10,372.54	214,419	14,401.34	297,702	9,000	3,465

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Baker	--------	--------	--------	--------	--------	--------	$46,964
Coos	--------	--------	--------	--------	--------	--------	718
Curry	--------	--------	--------	--------	--------	--------	1,485
Douglas	1,392	$127	--------	--------	--------	--------	13,465
Grant	308	28	1,711	$63	--------	--------	66,655
Jackson	--------	--------	1,786	66	--------	--------	95,087
Josephine	--------	--------	--------	--------	--------	--------	73,348
Lane	--------	--------	--------	--------	--------	--------	5,629
Linn	--------	--------	--------	--------	--------	--------	146
Malheur	--------	--------	--------	--------	--------	--------	15,932
Marion	--------	--------	--------	--------	--------	--------	26
Union	--------	--------	--------	--------	--------	--------	174
Wheeler	--------	--------	--------	--------	--------	--------	74
Total, 1931	1,700	155	3,497	129	--------	--------	319,703
Total, 1930	176,300	22,919	9,113	456	12,528	$601	325,143

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1930 and 1931, in terms of recovered metals

	Ore and old tailings (short tons)	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
Eastern:					
Lode	1,265	1,285.01	$26,563	4,092	$1,187
Placer		4,922.01	101,747	729	211
	1,265	6,207.02	128,310	4,821	1,398
Western:					
Lode	5,827	2,946.06	60,901	1,598	463
Placer		6,197.02	128,104	835	243
	5,827	9,143.08	189,005	2,433	706
Total, 1931	7,092	15,350.10	317,315	7,254	2,104
Total, 1930	8,994	14,401.34	297,702	9,000	3,465

	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Eastern:							
Lode	308	$28	1,711	$63			$27,841
Placer							101,958
	308	28	1,711	63			129,799
Western:							
Lode	1,392	127	1,786	66			61,557
Placer							128,347
	1,392	127	1,786	66			189,904
Total, 1931	1,700	155	3,497	129			319,703
Total, 1930	176,300	22,919	9,113	456	12,528	$601	325,143

MINING INDUSTRY

The mining industry of Oregon in 1931 was affected by the general business depression and drop in metal prices. Development work was continued at some of the larger properties, but only in a few instances was any new equipment added. Unfavorable water conditions restricted placer mining, and in August the streams of the State were at a very low stage.

The metals produced in western Oregon were valued at $189,904 and in eastern Oregon at $129,799 in 1931, compared with $196,035 and $129,108, respectively, in 1930. The largest decreases in value of production in 1931 were in Grant and Jackson Counties, but these were largely offset by increases in Baker, Douglas, Lane, and Malheur Counties. Lode mines yielded 7,092 tons of ore in 1931 compared with 8,994 tons of ore and old tailings in 1930; the average value of the recovered metals was $12.61 to the ton in 1931, compared with $12.24 in 1930. Placer material handled by dredges in 1931 totaled 1,687,550 cubic yards, with an average recovery of 8.20 cents a yard in gold and silver, compared with 2,147,108 cubic yards and 8.15 cents a yard in 1930. The yardage of material handled at hydraulic properties was indifferently reported by the operators and could not be estimated.

ORE CLASSIFICATION

Ore sold or treated in Oregon in 1931, with content in terms of recovered metals

Source	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	7,092	4,231.07	5,690	1,700	3,497	
Total, lode mines	7,092	4,231.07	5,690	1,700	3,497	
Total, placers		11,119.03	1,564			
	7,092	15,350.10	7,254	1,700	3,497	
Total, 1930	[1] 8,994	14,401.34	9,000	176,300	9,113	12,528

[1] Includes 3,880 tons of old tailings.

Ore sold or treated in Oregon in 1931, by counties, with content in terms of recovered metals

County	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Baker	701	688.52	144		
Curry	15	3.98			
Douglas	455	498.07	756	1,392	
Grant	549	588.11	3,944	308	1,711
Jackson	356	896.61	386		1,786
Josephine	4,697	1,298.35	336		
Lane	300	243.21	118		
Linn	4	5.84	2		
Union	15	8.38	4		
	7,092	4,231.07	5,690	1,700	3,497

METALLURGIC INDUSTRY

Ore mined in Oregon in 1931 amounted to 7,092 tons, of which 6,394 tons were treated at gold and silver mills, 197 tons treated at a concentrating mill, and 501 tons sent direct to smelters; no material was reported treated by cyanidation. Bullion recovered at 38 plants equipped for treating ore by amalgamation, not including hand mortars or arrastres, yielded $54,808 in gold and 657 ounces of silver. The total ore treated by amalgamation averaged in recovered metals $10.35 in gold and 0.12 ounce of silver to the ton. Ore was treated by flotation at only one mill in the State and yielded 22 tons of concentrates averaging in recovered metals $107.09 in gold and 131.82 ounces of silver to the ton, 1.45 percent lead, and a small amount of copper. The 501 tons of ore shipped direct to smelters yielded $37.03 in gold and 4.06 ounces of silver to the ton and less than 1 percent copper and lead. The ore and concentrates shipped from mines in Oregon in 1931 were smelted at Tacoma, Wash., Bradley, Idaho, and Selby, Calif.

Mine production of metals in Oregon in 1931, by methods of recovery

Method of recovery	Material treated (dry weight)	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	6,394	3,200.36	739			
Ore smelted	501	897.34	2,035	1,647	2,861	
Concentrates smelted:						
Flotation	22	113.97	2,900	53	636	
Table	6	19.40	16			
Total, lode mines		4,231.07	5,690	1,700	3,497	
Total, placers		11,119.03	1,564			
		15,350.10	7,254	1,700	3,497	
Total, 1930		14,401.34	9,000	176,300	9,113	12,528

Mine production of metals from gold and silver mills in Oregon, 1930 and 1931, in terms of recovered metals

	Ore and old tailings treated		Recovered in bullion				Concentrates and recovered metal		
			Amalgamation		Cyanidation		Concentrates produced	Gold	Silver
	Ore	Old tailings	Gold	Silver	Gold	Silver			
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*
Eastern	1,038		974.43	210			3	7.00	1
Western	5,356		2,225.93	529			3	12.40	15
Total, 1931	6,394		3,200.36	739			6	19.40	16
Total, 1930	2,969	3,880	3,008.18	609	30.95	203	11	34.04	10

Mine production of metals from concentrating mills in Oregon, 1930 and 1931, in terms of recovered metals

	Ore to concentrating mills	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1931 (all from Eastern)	197	22	113.97	2,900	53	636	
1930 (Eastern and Western)	1,014	135	531.37	4,535	873	8,721	12,528

Mine production of metals from Oregon concentrates, 1930 and 1931, in terms of recovered metals

	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Eastern	25	120.97	2,901	53	636	
Western	3	12.40	15			
Total, 1931	[1] 28	133.37	2,916	53	636	
Total, 1930	[1] 146	565.41	4,545	873	8,721	12,528

[1] 1931: All dry gold concentrate; 1930: Dry gold, lead, and zinc concentrates.

Mine production of metals from Oregon crude ore shipped to smelters, 1930 and 1931, in terms of recovered metals

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Eastern	30	189.61	981	255	1,075
Western	471	707.73	1,054	1,392	1,786
Total, 1931	[1] 501	897.34	2,035	1,647	2,861
Total, 1930	[1] 1,131	408.18	2,056	175,427	392

[1] 1931: All dry gold ore; 1930: Dry gold and copper ores.

REVIEW BY COUNTIES AND DISTRICTS

EASTERN OREGON

BAKER COUNTY

The value of the metals produced in Baker County increased from $20,733 in 1930 to $46,944 in 1931, due chiefly to larger gold yield from placers.

Baker, Eagle Creek, Sparta, and Virtue districts.—Nine lode mines near Baker produced 494 tons of ore yielding $12,176 in gold and 110 ounces of silver, valued together at $12,208, or $24.71 to the ton. Three placer operators, in Eagle Creek and the Sparta district, produced $508 in gold and silver. Most of the ore containing gold was from the White Swan mine near Baker, which was under examination. Gold was produced from the North Powder and Basin mines. Some gold from 1930 operations at the Gold Center claim was accounted for in 1931.

Connor Creek district.—In the Connor Creek district three placer-mine operators reported 29.89 ounces of gold and 6 ounces of silver from sluicing and drift mining.

Greenhorn district.—Three lode mines in the Greenhorn district produced 80 tons of ore yielding $1,191 in gold and 21 ounces of silver, valued together at $1,197, or $14.96 to the ton; the ore was treated by amalgamation and most of it was from the Banzette property. Five placers—the Blue Bucket, Good Hope, Mayflower, and Parkerville (all hydraulic mines) and a prospect—produced $661 in gold and silver.

Mormon Basin district.—Placer mining in the Mormon Basin district on the divide between Baker and Malheur Counties yielded $44,629 in gold and 369 ounces of silver. The principal part of the production came from the Superior dredge on Clarks Creek near Bridgeport in Baker County, operated under trusteeship by men who formerly held a lien against the boat. During the season the operator of the Mathewson hydraulic placer on Willow Creek in Malheur County handled 25,000 cubic yards of material yielding about $13,000 in gold.

Pine Creek district.—The Elliott placers on Pine Creek and the Old Reliable and Pal placers on Canyon and Cow Creeks in the Pine Creek district produced $822 in gold and 7 ounces of silver.

Sumpter district.—The Three Cents placer was the only producer of gold in the Sumpter district. Preparations were made to work the Powder river placers using the old dredge with a dragline bucket.

Weatherby district.—Three lode mines in the Weatherby district produced 127 tons of ore yielding $866 in gold and 13 ounces of silver, valued together at $870. Most of the ore was from the Little Bonanza group; the Hallock and Orion properties produced the rest.

GRANT COUNTY

The value of the metals produced in Grant County declined from $107,335 in 1930 to $66,655 in 1931, due chiefly to decreased output from placer mines.

Canyon district.—One dredge and miscellaneous small placers and lode mines in the Canyon district produced $55,394 in gold and 346 ounces of silver, valued together at $55,494. The Empire Gold Dredging & Mining Co., the leading gold producer in the district, operated a 2,500-cubic yard electric dredge and handled 714,950 cubic yards of material. Over 7 cents a cubic yard in gold was recovered.

Granite district.—Four lode mines and four placers, together with small prospects, in the Granite district produced 518 tons of ore, $8,828 in gold, 3,924 ounces of silver, 308 pounds of copper, and 1,711 pounds of lead, valued in all at $10,057. The ore yielded on the average $18.58 in metals a ton. Most of the metal produced was from the Buffalo-Monitor mine, worked by two leasing companies who shipped high-grade gold ore to the smelters and experimented with 197 tons of ore in a 40-ton flotation mill. The Rabbit mine produced gold ore taken from drifts and stopes on the upper level; the ore was treated in a 5-stamp amalgamation mill. Placers in the Granite district produced $430 in gold and silver.

Quartzburg district.—The Present Need and Keystone lode property in the Quartzburg district produced a little ore yielding gold and silver.

Susanville district.—The Pierson Bros. drift placer on Bear Creek produced gold 0.902 fine.

MALHEUR COUNTY

The metals produced in Malheur County in 1931 were valued at $15,932. The output came from the Mormon Basin district, mentioned under Baker County (see p. 673).

UNION AND WHEELER COUNTIES

In Union County the Twin Babies lode mine in the Medical Springs district was under development, and some ore was treated in a recently installed Denver quartz mill. In Wheeler County gold was recovered from sluicing material in the Spanish Gulch district.

WESTERN OREGON

COOS AND CURRY COUNTIES

In Coos County the gold recovered came largely from beach sands near Bullards and Bandon, where various devices have been used to extract the gold and platinum. Production in 1931 included $716 in gold and 8 ounces of silver, and also some platinum that was recovered and sold to refiners. In Curry County, from Cape Blanco south to Gold Beach, beach sands produced $1,400 in gold and 10 ounces of silver. Most of the gold bullion carried a little platinum. At the mouth of Mule Creek the Mule Mountain lode mine was operated, and a little gold was recovered from ore treated in a 5-ton amalgamation mill. In the Chetco district the Emily mine equipped with a 200-ton test mill continued under development.

DOUGLAS COUNTY

The value of the metals produced in Douglas County increased from $6,944 in 1930 to $13,465 in 1931, chiefly as a result of increased shipments of ore from South Myrtle Creek.

Cow Creek district.—One hydraulic placer and many small prospects on Cow Creek produced $1,066 in gold and 6 ounces of silver.

Green Mountain district.—The Cloudy Day lode mine and two small hydraulic placers in the Green Mountain district produced $2,086 in gold and 17 ounces of silver.

Nugget (South Myrtle Creek) district.—The Chieftain mine on South Myrtle Creek was under development, and gold ore was shipped to a smelter. The Continental mine produced ore of shipping grade containing gold, silver, and copper. The mine is opened by a vertical shaft 200 feet deep and an incline shaft 197 feet deep. Late in the year a new 50-ton mill with a 6-cell Fahrenwald flotation machine was completed, and some test runs were made.

Riddles district.—Two lode mines, the Huckleberry and Silver Peak, in the Riddles district produced a little high-grade gold ore. Prospectors panning and sluicing gravel in the district recovered a little gold sold to banks at Grants Pass.

JACKSON COUNTY

The value of the metals produced in Jackson County decreased from $111,178 in 1930 to $95,087 in 1931, chiefly because of the decline in dredging and hydraulicking.

Elk Creek district.—From the Buzzard mine on Elk Creek in northeastern Jackson County selected sulphide ore containing gold, silver, and lead was shipped to a smelter. The mine is owned by the Pearl Mining Co.

Gold Hill and Jacksonville districts.—Ten lode mines, one dredge, and many placer prospects in the Gold Hill and Jacksonville districts produced 314 tons of ore, $89,790 in gold, and 697 ounces of silver. The ore yielded on the average $54.47 in metals a ton. Except for one lot of gold ore shipped for smelting all the ore mined in the region was treated in amalgamation mills. The Discon Gold Mining Co. operated the Sylvanite mine 3 miles northeast of Gold Hill, shipped gold bullion, and continued development of the mine which is opened to a depth of 800 feet. Amalgamation mills near Gold Hill treated small lots of siliceous gold ore from the Golden Standard mine operated by a lessee, North Pole group, Revenue, Smuggler claims, and Carbonate mine on Evans Creek. The Opp mine in the Jacksonville district, recently leased to the Pacific States Mines Co., produced a little gold from the Huffer vein. Placer-mining activities were noted in many localities; the streams most frequently mentioned by the gold producers were the Kane, Galls, Foots, Pleasant, Sams, Sardine, Evans, Little Applegate, Wards, and Wagner. The Rogue River Gold Co. was an important producer of gold from dredge operations but due to shortage of flowing or underground water, the cumulative effect of four successive dry seasons, the dredge was not regularly in commission.

Upper Applegate district.—Placer mines and prospects and one lode mine in the Upper Applegate district produced gold dust and gold from pocket mining yielding $4,286 in gold and 32 ounces of silver. Most of the gold was from placers along the Little Applegate River and its tributaries and was sold chiefly to nearby merchants and to banks at Grants Pass.

JOSEPHINE COUNTY

The value of the metals produced in Josephine County declined from $73,541 in 1930 to $73,348 in 1931. The decreased output from lode mines was nearly offset by increased placer production.

Galice district.—Four lode mines and many small placers in the Galice district produced 4,109 tons of ore, $15,061 in gold, and 108 ounces of silver. The ore yielded on an average $2.45 a ton in gold and silver. The placer output totaled $5,008 in gold and 35 ounces of silver. The Penn Mining Syndicate operated the Bunker Hill property and remodeled the amalgamation mill to handle low-grade ore; some gold was produced incidental to development of the property. Other producing lode mines were the J. C. L., the Oriole, and the Copper Stain gold mine in the Mount Reuben section.

Grants Pass district.—Small placers in the Grants Pass district produced $4,631 in gold and 36 ounces of silver. Most of the gold was reported from Jump-off Joe Creek; small lots came from Louse and Pickett Creeks and from Dry Diggings and Winona, two old fields formerly productive. The banks at Grants Pass handled most of the gold, but some of it was shipped direct to the San Francisco Mint.

Greenback district.—Two lode mines and many placers in the Greenback district produced $13,504 in gold and 88 ounces of silver. The Columbia Placers, Inc., hydraulicking the gravels of the Jewett and Yellow Horn properties, was the largest producer, followed by the Ruble hydraulic placer. The output of small placers was important; most of them were on Wolf Creek, Grave Creek, and Coyote Creek. The Greenback and Spotted Fawn, the latter equipped with a 5-ton Chilean mill, produced small quantities of gold.

Illinois River region.—Three lode mines and many placers in the Illinois River region produced $23,845 in gold and 140 ounces of silver compared with $14,056 in gold, 242 ounces of silver, and 149,274 pounds of copper, valued in all at $33,555, in 1930. The region comprises the drainage area of the Illinois River and its tributaries, Josephine Creek, Sucker Creek, and the West Fork near Selma, Kerby, Holland, Althouse, Takilma, and Waldo. Most of the gold was produced from three placer properties—the Leonard mine near Holland, the Osgood, and the Llano De Oro—all hydraulic properties in the Waldo district. The producing lode mines were the Lightning claim near Kerby and the Boswell and Siskron near Holland, all using small stamp mills for reducing the ore and then treatment by amalgamation.

Lower Applegate district.—The Humdinger mine and mill on Williams Creek in the Lower Applegate district were recently acquired by a mining syndicate. The amalgamation mill was reconditioned and a table concentrator added. Some gold and silver were produced from ore mined during development of the property. Many individuals panned or sluiced gold from gravels of Oscar, Slate, and Williams Creeks; the gold was sold to local merchants.

LANE AND LINN COUNTIES

Bohemia district.—No direct reports were received from mine operators in Lane County, although a little gold bullion was sold to bullion buyers who reported activity where stream gravel could be worked by individuals. The output of the county, including that of one lode mine, totaled $5,594 in gold and 120 ounces of silver; it came from the Bohemia district.

Quartzville district.—In the Quartzville district in Linn County the Mayflower lode mine and some small placers produced $145 in gold and 2 ounces of silver.

MARION COUNTY

A little gold was recovered by prospectors from placers in the North Santiam district, according to merchants who purchased the gold.

GOLD AND SILVER[1]

(GENERAL REPORT)

By J. P. Dunlop

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[1] Work on manuscript completed March 1933.

DOMESTIC PRODUCTION

Approximate distribution of the production of gold and silver in the United States in 1931, by producing States and Territories

[Figures supplied by the U.S. Bureau of the Mint]

State or Territory	Gold		Silver		Increase or decrease from 1930	
	Fine ounces	Value[1]	Fine ounces	Value[2]	Gold	Silver (fine ounces)
Alabama	39	$800	6	$2	+$600	+6
Alaska	466,006	9,633,200	397,949	115,405	+1,212,400	+5,925
Arizona	136,805	2,828,000	4,070,860	1,180,549	−245,500	−839,534
California	521,158	10,773,300	777,025	225,337	+1,465,000	−657,101
Colorado	225,147	4,654,200	2,373,706	688,375	+142,400	−2,477,865
Georgia	77	1,600	11	3	−2,600	−12
Idaho	18,058	373,300	7,416,044	2,150,653	−64,900	−2,294,106
Illinois						−1,896
Michigan			2,024	587		−8,696
Missouri			1,800	522		−185,748
Montana	40,901	845,500	4,076,872	1,182,293	−124,000	−4,520,094
Nevada	139,194	2,877,400	2,368,624	686,901	−21,200	−1,810,319
New Mexico	31,981	661,100	1,070,452	310,431	+8,100	−89,922
North Carolina	344	7,100	20,193	5,856	−3,200	−12,698
Oregon	15,301	316,300	7,487	2,171	+20,700	−2,329
Pennsylvania	237	4,900	1,604	465	−7,700	−2,934
Philippine Islands	182,137	3,765,100	110,008	31,902	−63,500	−10,876
South Carolina	24	500			+500	
South Dakota	431,200	8,913,700	113,410	32,889	+514,800	+8,244
Tennessee	397	8,200	41,968	12,171	−6,700	−43,565
Texas			241	70	−5,000	−468,495
Utah	183,462	3,792,500	8,057,015	2,336,534	−526,600	−6,394,251
Vermont						−4,512
Washington	3,357	69,400	24,716	7,168	−6,000	−5,137
Wyoming	53	1,100	35	10	−8,000	−162
	2,395,878	49,527,200	30,932,050	8,970,294	+2,279,600	−19,816,077

[1] Gold valued at $20.67+ a fine ounce.

[2] Silver valued at 29 cents a fine ounce. Average New York price of bar silver.

The figures in the preceding table were obtained through cooperation between the United States Bureau of the Mint and the Bureau of Mines and were agreed upon after conference and adjustment between the two bureaus. They are therefore final for both.

The totals are based on bullion deposits in the United States mints and assay offices and on returns to the Bureau of the Mint from the smelting and refining companies. The distribution is adjusted by means of information collected by the Bureau of Mines directly from the producing mines and tabulated for the mine reports discussed later. The data for the total production and in part for the distribution are obtained from records of (1) the unrefined domestic gold and silver deposited in the United States mints and assay offices, (2) the domestic gold and silver in fine bars reported by private refineries, and (3) the unrefined domestic gold and silver contained in ore and matte exported for reduction. The last item is very small.

Domestic smelters recovered 829,997 fine ounces of gold and 66,693,028 fine ounces of silver from foreign ores and bullion, a decrease of 424,157 ounces of gold and 15,411,750 ounces of silver compared with 1930.

The value of the new gold used in the arts and manufactures in the United States in 1931 was $5,930,780 compared with $15,177,739 in 1930. The quantity of new silver used for such purposes was 24,335,838 ounces compared with 26,874,378 ounces in 1930. In addition to the new gold used in the arts and industries $23,227,085 in gold recovered from waste material was also utilized. The total quantity of silver (new and old) used in the arts and manufactures was 33,682,119 ounces (2,661,088 less than in 1930). In addition to the gold and silver derived from foreign and domestic ore and bullion $17,992,186 in gold and 6,954,888 ounces of silver were recovered from old or obsolete jewelry, silverware, dental waste, old films, and other material. Nearly all the silver was handled by private refineries, as the purchase of silver bullion by United States mints and assay offices was confined to that contained in deposits of gold plus any additional quantity required for subsidiary coinage.

Gold and silver produced in the United States, 1792–1931

[The estimate for 1792–1872 is by R. W. Raymond, commissioner, and for the period since 1872 by the Director of the Mint]

Period	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
1792–1847	1,186,977	$24,537,000	309,500	$404,500
1848–72	58,279,781	1,204,750,000	118,568,200	157,749,900
1873–1931	164,409,950	3,398,655,300	3,079,337,904	2,355,641,511
	223,876,708	4,627,942,300	3,198,215,604	2,513,795,911

The average commercial value per fine ounce of silver for the total recorded domestic production is $0.786.

PRICES OF SILVER

The average monthly prices of fine bar silver in New York in 1931 follow:

Price of silver per fine ounce in 1931, by months

January	$0.29736	August	$0.27842
February	.27085	September	.28500
March	.29504	October	.29846
April	.28589	November	.32535
May	.27962	December	.30432
June	.27562		
July	.28567	Average	.29013

Price of silver per fine ounce, 1927–31 [2]

1927	$0.567	1930	$0.385
1928	.585	1931	.290
1929	.533		

The yearly price of silver showed a fairly regular downward trend—from $1.337 and $1.339 in 1865 and 1866 to $0.507 in 1915. The World War caused the price to advance; the downward trend was steady from 1923 to 1927. There was an increase of about 2 cents an ounce in 1928, followed by a decrease of about 5 cents an ounce in 1929. The average yearly price for 1930 decreased to $0.385; in 1931 the price was as low as 25 cents during the first half of the year, and the average yearly price was 29 cents an ounce. The value of exports of silver in 1931 was about $27,671,300 less than in 1930. Exports of domestic bullion amounted to 75,568,657 ounces, of which 19,160,854 ounces went to India, 30,312,383 ounces to China, and 21,854,762 ounces to Germany and Great Britain.

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[2] Average New York price for all silver.

More than half the world output of silver is derived from ores valued chiefly for metals other than silver, so that the price of silver has less weight in encouraging the bulk of silver production than that of other metals associated with it. Only about one third of the world silver output is derived from ores having silver as a highly predominant factor.[3]

Other information relating to the production of silver has been published by the Bureau of Mines.[4]

It has been estimated that 75 percent of the silver consumed in the world has been employed in money and less than 25 percent in arts and industries.[5]

IMPORTS AND EXPORTS[6]

Value of gold and silver imported into and exported from the United States, 1930 and 1931, by classes

	Imports	Exports	Excess of—	
			Imports	Exports
1930				
Gold:				
Contained in domestic ore and base bullion		$43,826		$43,826
Contained in foreign ore and base bullion	$17,565,829		$17,565,829	
Domestic bullion refined	9,465,478	75,452,202		65,986,724
Foreign bullion refined	47,012,149		47,012,149	
United States coin	160,801,740	39,219,063	121,582,677	
Foreign coin	161,208,499	1,252,241	159,956,258	
	396,053,695	115,967,332	346,116,913	66,030,550
Excess imports over exports			280,086,363	
Silver:				
Contained in domestic ore and base bullion		1,546		1,546
Contained in foreign ore and base bullion	21,275,154		21,275,154	
Domestic bullion refined	76,537	43,502,964		43,426,427
Foreign bullion refined	17,825,676	7,392,959	10,432,717	
United States coin	1,810,222	45,076	1,765,146	
Foreign coin	1,773,252	3,214,039		1,440,787
	42,760,841	54,156,584	33,473,017	44,868,760
Excess exports over imports				11,395,743
1931				
Gold:				
Contained in domestic ore and base bullion		33,354		33,354
Contained in foreign ore and base bullion	32,694,434		32,694,434	
Domestic bullion refined	55,058,583	385,957,242		330,898,659
Foreign bullion refined	111,053,605	5,666	111,047,939	
United States coin	311,766,842	80,783,994	230,982,848	
Foreign coin	101,545,747	14,203	101,531,544	
	612,119,211	466,794,459	476,256,765	330,932,013
Excess imports over exports			145,324,752	
Silver:				
Contained in domestic ore and base bullion		3,380		3,380
Contained in foreign ore and base bullion	11,734,914		11,734,914	
Domestic bullion refined	52,350	21,664,216		21,611,866
Foreign bullion refined	11,478,777	2,092,870	9,385,907	
United States coin	3,496,197	51,629	3,444,568	
Foreign coin	1,901,901	2,673,158		771,257
	28,664,139	26,485,253	24,565,389	22,386,503
Excess imports over exports			2,178,886	

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[3] Merrill, C. W., Economic Relations of Silver to Other Metals in Argentiferous Ores: Econ. Paper 10, Bureau of Mines, 1930, 29 pp.

[4] Merrill, C. W., Summarized Data of Silver Production: Econ. Paper 8, Bureau of Mines, 1930, 58 pp.

[5] Merrill, C. W., Consumption of Silver in the Arts and Industries of the United States: Econ. Paper 14, Bureau of Mines, 1932, 18 pp.

[6] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

DOMESTIC SUPPLY

The total excess of imports of gold over exports from 1916 to 1931, inclusive, was $2,170,987,870. The only years since 1916 in which exports of gold exceeded imports were 1919, when the excess was $292,000,000; 1925, when the excess was $134,000,000; and 1928, when the excess was $391,862,000. The large gain in the domestic supply of gold is illustrated best by the following figures, which show the excess of imports over exports: 1916, $530,000,000; 1917, $180,000,000; 1918, $21,000,000; 1920, $95,000,000; 1921, $667,000,000; 1922, $238,000,000; 1923, $294,000,000; 1924, $258,000,000; 1926, $98,000,000; 1927, $6,000,000; 1929, $175,000,000; 1930, $280,000,000; and 1931, $145,325,000.

The domestic supply of new gold comes chiefly from dry and siliceous ore and from placer gravel worked largely by dredges. These two sources yielded 90.2 percent of the domestic gold in 1915, 78.5 percent in 1926, 76.6 percent in 1927, 75.1 percent in 1928, 72 percent in 1929, 79.86 percent in 1930, and 86.5 percent in 1931. The proportionate output of gold from copper ore was 7.2 percent in 1915, 16.4 percent in 1926, 17.4 percent in 1927, 19.3 percent in 1928, 22.2 percent in 1929, 15.57 percent in 1930, and 9.65 percent in 1931.

In 1931 the domestic supply of new silver came chiefly from copper ore, lead-zinc ore, lead ore, and dry and siliceous silver and silver-gold ores, in the proportion of 32.1, 23.3, 20.5, and 14.6 percent, respectively, compared with 28.53, 27.33, 18.40, and 18.32 percent in 1930. In 1915 dry and siliceous ore yielded 36 percent of the silver, copper ore 26 percent, lead ore 27 percent, and lead-zinc ore only 9 percent. Thus, the largest gain in the output of silver has been from lead-zinc ore and the greatest loss from dry and siliceous ore.

WORLD PRODUCTION

GOLD

The estimated value of the gold produced in the world from 1860 to 1931, inclusive, is about $17,987,775,000. For 1931 the estimated production of the world is recorded as $459,104,500, an increase of $28,379,600 over 1930. There were increases of about $27,621,000 in 1930, $6,706,600 in 1928, $1,696,700 in 1927, $6,680,600 in 1926, $25,641,400 in 1924, and $48,344,200 in 1923, and decreases of $104,600 in 1925 and $5,281,100 in 1929, with successive annual decreases from 1915 to 1922.

In a Bureau of Mines publication [7] the world production of gold from 1493 to 1927, inclusive, is estimated at approximately 1,003,560,000 ounces, of which 51.5 percent was produced from 1901 to 1927.

The two most important gains in output of gold in 1931 were made by Canada, with an increase of $12,158,000, and Russia, with an increase of $5,525,500. Other countries reported the following large advances in output: Australasia, $3,350,500; South Africa, $3,337,000; United States (excluding the Philippine Islands), $2,343,100; Japan, $749,500; Colombia, $734,700; Sweden, $620,200; and Brazil, $387,000. Large decreases in output of gold in 1931 were as follows: Mexico, $981,600; Venezuela, $281,900; Peru, $219,900; and Ecuador, $214,600.

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[7] Ridgway, R. H., Summarized Data of Gold Production: Econ. Paper 6, Bureau of Mines, 1929, 63 pp.

For the last 11 years mines in Transvaal, Natal, and Cape Colony have been producing more than half the world gold supply.

The following table shows the gold output by countries as given by the Bureau of the Mint:

World production of gold, 1926–31

Country	1926	1927	1928	1929	1930	1931
North America:						
Canada	$36, 263, 100	$38, 300, 500	$39, 082, 000	$39, 861, 700	$43, 557, 100	$55, 715, 100
Central America	1, 800, 000	1, 500, 000	1, 250, 000	1, 100, 000	1, 200, 000	1, 400, 000
Mexico	15, 972, 300	14, 990, 700	14, 451, 700	13, 535, 900	13, 860, 200	12, 878, 600
United States [1]	46, 276, 300	43, 767, 500	44, 335, 300	42, 514, 300	43, 419, 000	45, 762, 100
South America:						
Argentina	50, 000	20, 000	20, 000	20, 700	20, 700	------------
Bolivia	6, 900	5, 000	10, 500	31, 000	340, 700	358, 200
Brazil	2, 110, 800	2, 120, 100	2, 069, 600	2, 219, 800	2, 000, 000	2, 387, 000
Chile	1, 222, 400	1, 240, 300	595, 500	221, 900	344, 900	345, 600
Colombia	1, 481, 300	1, 500, 000	833, 600	1, 000, 000	3, 281, 200	4, 015, 900
Ecuador	1, 291, 700	1, 328, 000	1, 541, 500	1, 391, 800	1, 447, 000	1, 232, 400
Guiana:						
British	134, 700	118, 100	110, 100	132, 000	143, 300	143, 500
French	935, 100	999, 600	939, 700	850, 300	900, 000	899, 900
Netherland	155, 600	158, 800	113, 700	61, 500	81, 600	95, 000
Peru	2, 485, 600	1, 915, 400	1, 383, 000	2, 524, 800	1, 861, 500	1, 641, 600
Venezuela	631, 300	813, 800	997, 600	893, 100	1, 156, 500	874, 600
Europe:						
Austria	27, 200	2, 700	6, 600	------------	------------	------------
Czechoslovakia	159, 500	155, 000	143, 500	103, 700	49, 900	22, 600
France	868, 400	930, 400	1, 116, 500	1, 116, 500	881, 900	881, 900
Germany	107, 600	119, 600	112, 300	120, 300	125, 600	85, 100
Great Britain	------------	------------	2, 700	200	------------	------------
Greece	------------	10, 000	10, 000	10, 000	10, 000	10, 000
Italy	35, 200	44, 500	38, 600	31, 900	35, 600	44, 800
Rumania	1, 150, 400	1, 367, 800	1, 294, 600	1, 470, 800	1, 775, 800	1, 994, 400
Russia	20, 509, 700	21, 931, 800	24, 806, 200	20, 671, 800	29, 636, 500	35, 162, 000
Spain	20, 000	20, 000	15, 000	10, 000	10, 000	10, 000
Sweden	305, 700	305, 700	289, 400	206, 700	1, 240, 300	1, 860, 500
Yugoslavia	214, 700	256, 500	299, 100	381, 500	478, 500	451, 900
Asia:						
China	2, 273, 900	2, 067, 200	2, 067, 200	1, 033, 600	2, 000, 000	2, 000, 000
Chosen	3, 940, 500	3, 706, 800	3, 440, 000	2, 843, 200	3, 299, 400	3, 500, 000
East Indies:						
British	400, 000	------------	------------	------------	------------	------------
Netherland	2, 384, 600	2, 337, 400	2, 278, 900	2, 230, 500	2, 282, 900	2, 068, 900
Federated Malay States	299, 200	221, 300	386, 400	505, 000	611, 800	609, 000
India, British	7, 937, 400	7, 943, 500	7, 773, 800	7, 521, 800	6, 805, 800	6, 831, 700
Indo-China	6, 600	6, 600	5, 300	10, 600	10, 600	6, 000
Japan	6, 364, 100	6, 383, 900	6, 905, 700	7, 360, 200	8, 036, 000	8, 785, 500
Philippine Islands	1, 886, 100	1, 639, 600	2, 204, 500	3, 320, 400	3, 704, 500	3, 761, 900
Sarawak	5, 000	5, 000	4, 100	29, 000	35, 700	122, 000
Taiwan	186, 800	303, 700	186, 300	311, 800	322, 000	350, 000
Turkey	19, 900	19, 900	18, 600	18, 600	18, 600	18, 600
Africa	226, 580, 500	228, 870, 700	233, 033, 400	235, 346, 900	242, 884, 900	246, 572, 800
Australasia	13, 481, 600	14, 251, 000	14, 212, 500	12, 090, 100	12, 854, 900	16, 205, 400
	399, 981, 700	401, 678, 400	408, 385, 000	403, 103, 900	430, 724, 900	459, 104, 500

[1] Philippine Islands excluded.

SILVER

The world production of silver decreased from 248,708,400 fine ounces in 1930 to 192,710,000 ounces in 1931. The largest decreases were: United States (excluding the Philippine Islands), 19,805,200 ounces; Mexico, 19,346,400 ounces; Peru, 6,543,400 ounces; Canada, 5,877,700 ounces; Australasia, 1,485,900 ounces; Bolivia, 1,318,800 ounces; and Burma, 1,149,000 ounces. North America and South America produced all but about 19 percent of the world silver output, of which about half was produced or refined in the United States.

World production of silver, 1926–31, in fine ounces

Country	1926	1927	1928	1929	1930	1931
North America:						
Canada	22, 371, 900	22, 736, 700	21, 936, 400	23, 143, 300	26, 435, 900	20, 558, 200
Central America	3, 499, 100	3, 154, 000	2, 558, 500	3, 000, 000	3, 900, 000	4, 000, 000
Mexico	98, 291, 200	104, 573, 900	108, 537, 300	108, 871, 400	105, 410, 900	86, 064, 500
United States[1]	62, 673, 000	60, 394, 200	58, 426, 000	61, 233, 300	50, 627, 200	30, 822, 000
South America:						
Argentina	15, 000	15, 000	15, 000	15, 000	15, 000	----------
Bolivia	5, 834, 000	5, 402, 800	5, 638, 800	4, 816, 200	7, 091, 100	5, 772, 300
Brazil	20, 700	15, 600	25, 600	21, 000	20, 000	10, 000
Chile	2, 876, 900	2, 900, 000	1, 436, 700	328, 500	732, 400	372, 400
Colombia	126, 000	131, 400	68, 200	60, 000	60, 000	40, 000
Ecuador	80, 000	87, 600	79, 800	96, 500	106, 100	104, 800
Guiana	8, 000	8, 000	7, 500	7, 500	7, 500	6, 000
Peru	21, 499, 800	18, 295, 400	21, 607, 700	21, 495, 200	15, 500, 400	8, 957, 000
Venezuela	3, 200	3, 200	4, 000	4, 000	4, 200	4, 200
Europe:						
Austria	14, 100	9, 700	18, 900	10, 600	10, 200	10, 200
Czechoslovakia	765, 500	750, 000	767, 700	723, 000	890, 600	899, 300
France	261, 800	308, 600	360, 100	360, 100	652, 000	652, 000
Germany	5, 358, 900	5, 293, 400	5, 220, 800	5, 512, 800	5, 485, 400	5, 784, 600
Great Britain	41, 300	46, 700	32, 800	36, 000	41, 000	34, 000
Greece	254, 300	241, 100	241, 100	241, 100	241, 100	192, 900
Italy	519, 400	537, 100	514, 400	518, 700	571, 700	719, 300
Norway	308, 600	315, 100	398, 700	282, 900	337, 800	297, 400
Poland	271, 700	250, 000	235, 100	360, 600	558, 700	558, 700
Rumania	93, 700	140, 700	100, 000	90, 700	142, 000	155, 800
Russia	250, 000	321, 500	380, 000	300, 000	300, 000	350, 000
Spain	3, 000, 700	3, 056, 600	2, 526, 500	2, 659, 200	2, 659, 200	3, 098, 700
Sweden	80, 400	80, 400	75, 000	75, 000	75, 000	80, 000
Yugoslavia	45, 000	53, 800	62, 700	80, 000	100, 300	94, 700
Asia:						
Burma	5, 100, 000	6, 000, 000	7, 400, 000	7, 273, 300	7, 047, 000	5, 898, 000
China	135, 000	100, 000	100, 000	50, 000	50, 000	60, 000
Chosen	51, 900	51, 400	56, 100	60, 100	68, 800	65, 000
East Indies, Netherland	2, 363, 800	2, 285, 800	2, 032, 000	1, 967, 900	2, 094, 200	1, 473, 100
India, British	25, 000	24, 800	25, 800	25, 000	25, 000	25, 000
Indo-China	----------	10, 200	53, 200	3, 200	3, 200	1, 600
Japan	4, 776, 100	4, 531, 500	5, 144, 900	5, 674, 700	5, 628, 600	5, 000, 000
Philippine Islands	44, 000	28, 400	36, 400	101, 500	110, 300	97, 100
Taiwan	14, 300	18, 100	11, 700	13, 000	15, 200	12, 000
Turkey	225, 000	225, 100	220, 000	220, 000	220, 000	200, 000
Africa:						
Algeria	169, 100	118, 100	117, 400	166, 900	167, 000	150, 000
Bechuanaland	400	400	100	100	400	700
Belgian Congo	----------	10, 600	10, 600	12, 000	13, 000	15, 000
British West Africa (Gold Coast, Ashanti, Nigeria)	----------	----------	----------	----------	200	252, 900
East Africa, Portuguese	1, 100	700	300	100	40	100
Rhodesia	117, 800	131, 600	103, 900	100, 500	73, 360	76, 500
Tanganyika and Kenya Colony	800	900	1, 700	1, 200	1, 400	1, 900
Transvaal, Cape Colony, Natal	981, 300	1, 011, 700	1, 031, 400	1, 031, 800	1, 050, 000	1, 063, 000
Australasia	11, 225, 400	10, 309, 300	10, 304, 400	9, 926, 100	10, 165, 000	8, 679, 100
	253, 795, 200	253, 981, 100	257, 925, 200	260, 970, 000	248, 708, 400	192, 710, 000

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[1] Philippine Islands excluded.

MINE REPORT

METHOD OF COLLECTING STATISTICS

The first table in this report presents the final official figures of the production of gold and silver in the United States in 1931, as agreed upon by the Bureau of the Mint and the Bureau of Mines. With the comparatively unimportant exceptions of domestic gold and silver contained in ore and matte exported for reduction during the year, these figures record the production of gold and silver bullion from domestic ore in marketable form as metals, either refined or unrefined.

To trace this total gold and silver produced back to its source by States, counties, and mining districts, the Bureau of Mines makes a systematic investigation of the "mine production" of ores containing gold and silver and of the output of the placer mines, the output being classified by methods of production and by kinds of ore, as well as by mining districts. The resulting figures form the basis of the mine reports.

Of the two plans for ascertaining the gold and silver production, one is a measure of the metallurgic industry and the other a measure of the mining industry; one reports the metal actually recovered in marketable form and the other the mine output and its recoverable content. The two methods will not produce exactly corresponding results, but the figures for a period of years sufficiently long to compensate for overlap or lag should agree within allowable limits of error.

Gold and silver produced in the United States, 1905–31, according to mint and mine returns

Year	Mint		Mine	
	Gold	Silver	Gold	Silver
		Fine ounces		*Fine ounces*
1905–27	$1,741,269,900	1,435,171,052	$1,727,954,727	1,429,420,425
1928	46,165,400	58,462,507	46,308,487	57,909,870
1929	45,651,400	61,327,868	45,883,477	60,961,491
1930	47,247,600	50,748,127	47,916,142	47,835,181
1931	49,527,200	30,932,050	49,751,668	29,953,728
	1,929,861,500	1,636,641,604	1,917,814,501	1,626,080,695

According to the reports of the mint, these figures show a total excess of gold for the 27 years of $12,047,000 (a difference of only 0.624 percent) and a total excess of silver of 10,560,909 ounces (a difference of 0.645 percent).

UNITS OF MEASUREMENT

In the measurement of ores and concentrates the short ton of 2,000 pounds is used throughout. The price of gold is fixed by law at $20.67+ per fine ounce. The annual average prices for silver from 1927 to 1931 are given on page 681.

MINES PRODUCING

LEADING GOLD PRODUCERS

About $34,170,000 in gold (74 percent of the mine output of the United States, Philippine Islands excluded) represented the yield of 25 companies, none of which produced less than $325,000. The Homestake Mining Co. of South Dakota was the largest producer. The Alaska Juneau Gold Mining Co. of Alaska ranked second in total output of gold; and the Empire Star Mines Co., Ltd., of California, ranked fourth. The Fairbanks Exploration Co., of Alaska, was the largest producer of gold by dredging, and the Utah Copper Co., of Utah, had the largest yield of gold from base ores. Of the largest producers, 9 were in California; 4 in Alaska; 3 each in Arizona, Colorado, and Utah; 2 in Nevada; and 1 in South Dakota. Of these companies, 15 produced gold from dry and siliceous ore; 5 from gravel by dredging; 2 from copper ore; 1 from copper ore and lead-zinc ore; 1 from copper ore and lead ore; and 1 from siliceous ore, lead ore, copper ore, and lead-zinc ore.

Larger producers of gold in the United States in 1931, in order of output

Rank	Operator	State	Mining district	Source of gold
1	Homestake Mining Co	South Dakota	Whitewood	Dry and siliceous ore.
2	Alaska Juneau Gold Mining Co	Alaska	Juneau	Do.
3	Golden Cycle Mining & Reduction Co.[1]	Colorado	Cripple Creek	Do.
4	Empire Star Mines Co., Ltd	California	Grass Valley	Do.
5	Fairbanks Exploration Co	Alaska	Fairbanks	Dredging gravel.
6	Natomas Co. of California	California	Natoma	Do.
7	Utah Copper Co	Utah	West Mountain	Copper ore and lead-zinc ore.
8	Eureka Standard Mining Co	do	Tintic	Dry and siliceous ore.
9	Yuba Consolidated Gold Fields	California	Maryville	Dredging gravel.
10	United States Smelting, Refining & Mining Co.	Utah	West Mountain	Copper ore, siliceous ore, lead ore, and lead-zinc ore.
11	Hammon Consolidated Gold Fields	Alaska	Nome	Dredging gravel.
12	London Gold Mines Co	Colorado	Mosquito Creek	Dry and siliceous ore.
13	Phelps Dodge Corporation (Copper Queen and New Cornelia).	Arizona	Warren	Copper ore and lead ore.
14	Tom Reed Gold Mines Co	do	San Francisco	Dry and siliceous ore.
15	Kennedy Mining & Milling Co	California	Jackson	Do.
16	Idaho Maryland Mines Co	do	Grass Valley	Do.
17	Shenandoah Dives Mining Co	Colorado	San Juan	Do.
18	Capital Dredging Co	California	Folsom	Dredging gravel.
19	Original Sixteen to One Mines, Inc	do	Alleghany	Dry and siliceous ore.
20	Nevada Consolidated Copper Co	Nevada	Robinson	Copper ore.
21	American Foundation Co	California	Nevada City	Dry and siliceous ore.
22	Elkoro Mines Co	Nevada	Jarbidge	Do.
23	Argonaut Mining Co	California	Jackson	Do.
24	Willow Creek Mines, Inc	Alaska	Willow Creek	Do.
25	Calumet and Arizona Mining Co	Arizona	Warren	Copper ore.

[1] Custom mill. Includes ore from Cresson, Portland, United Gold, and other mines.

Besides the output of these 25 large operators about $11,819,000 came from smaller producers; some of them produced as much as $250,000, but the majority produced relatively small quantities of gold. The Benguet and Balatoc mines in the Philippine Islands, controlled by the Benguet Consolidated Mining Co. (not included in the preceding list), had a combined output in 1931 exceeded only by that of the Homestake and Alaska Juneau properties.

LEADING SILVER PRODUCERS

The output of silver from the 25 leading producing companies in 1931 was about 23,612,000 ounces or 79 percent of the total (excluding the Philippine Islands). Eight of these properties each produced more than 1,000,000 ounces, and none yielded less than 285,000 ounces. The largest silver producer was the Anaconda Copper Mining Co., followed by the Sunshine Mining Co. and the Bunker Hill & Sullivan Mining & Concentrating Co. Three properties in Idaho, 3 in Utah, and 1 each in Montana and Colorado produced more than 1,000,000 ounces of silver in 1931. Of the 25 large silver producers 8 were in Utah, 4 each in Arizona and Idaho, 3 in Nevada, 2 each in

Colorado and New Mexico, and 1 each in California and Montana. Three of these companies recovered silver from dry and siliceous ore; 6 from copper ore; 4 from lead ore and lead-zinc ore; 1 from lead ore; 1 from dry and siliceous ore, lead ore, and lead-zinc ore; 2 from dry and siliceous ore and lead ore; 2 from copper ore, lead ore, and lead-zinc ore; 3 from lead-zinc ore; 1 from copper-lead ore; 1 from dry and siliceous ore and lead-zinc ore; and 1 from dry and siliceous ore, copper ore, and lead-zinc ore.

Larger producers of silver in the United States in 1931, in order of output

Rank	Operator	State	Mining district	Source of silver
1	Anaconda Copper Mining Co	Montana	Summit Valley (Butte).	Copper ore.
2	Sunshine Mining Co	Idaho	Evolution	Copper-lead ore.
3	Bunker Hill & Sullivan Mining & Concentrating Co.	do	Yreka	Lead ore.
4	Tintic Standard Mining Co	Utah	Tintic	Lead ore and siliceous ore.
5	Silver King Coalition Mines Co	do	Uintah	Lead ore and lead-zinc ore.
6	Empire Zinc Co	Colorado	Battle Mountain	Dry and siliceous ore, copper ore, and lead-zinc ore.
7	United States Smelting, Refining & Mining Co.	Utah	West Mountain	Lead ore, lead-zinc ore, and copper ore.
8	Hecla Mining Co	Idaho	Lelande	Lead ore and lead-zinc ore.
9	Federal Mining & Smelting Co	do	Hunter and Warm Springs.	Do.
10	Calumet and Arizona Mining Co	Arizona	Warren	Copper ore.
11	Magma Copper Co	do	Pioneer	Do.
12	Treadwell Yukon Co., Ltd	Nevada	Tybo	Lead and lead-zinc ore.
13	Phelps Dodge Corporation (Copper Queen).	Arizona	Warren	Copper ore.
14	Utah Copper Co	Utah	West Mountain	Copper ore, lead-zinc ore, and lead ore.
15	Eureka Standard Mining Co	do	Tintic	Dry and siliceous ore.
16	Tonopah Mining Co	Nevada	Tonopah	Do.
17	Shenandoah Dives Mining Co	Colorado	San Juan	Do.
18	American Metal Co	New Mexico	Willow Creek	Lead-zinc ore.
19	Plutus Mining Co	Utah	Tintic	Dry and siliceous ore and lead ore.
20	Black Hawk Consolidated Mines Co.	New Mexico	Central	Lead-zinc ore.
21	United Verde Copper Co	Arizona	Verde	Copper ore.
22	Walker Mining Co	California	Genesee	Do.
23	Park Utah Consolidated Mines Co.	Utah	Blue Ledge and Snake Creek.	Dry and siliceous ore, lead ore, and lead-zinc ore.
24	Combined Metals Reduction Co	Nevada	Pioche	Lead-zinc ore.
25	Park City Consolidated Mines Co.	Utah	Park City	Mainly lead-zinc ore and dry and siliceous ore.

NUMBER OF MINES

The following table indicates the number of mines that produced gold and silver in 1931. The placers are those in which the gold and the silver in natural alloy with the gold and, in a few placers, with platinum are recovered from gravel and sand, whether by hand washing, sluicing, hydraulicking, drifting (in frozen ground or ancient buried river channels), or dredging. The lode mines are those producing gold and silver (from ore as distinguished from gravel) mainly from underground workings, including those which yield ore valuable chiefly for copper, lead, or zinc but which contribute precious metals as byproducts. In addition to producing mines enumerated here, many properties were being prospected and developed, and many other mining claims were being held by assessment work only.

The enumeration of placer mines is less satisfactory than that of lode mines, because some are being operated only temporarily and are individually small and because much of the production is made by transitory miners not regularly working placer ground. So far as possible the unit is, as for lode mines, not the operator but the mining claim or group of claims.

Number of mines in the United States producing gold and silver in 1931, by States [1]

State	Placer	Lode	Total	State	Placer	Lode	Total
Alabama	1	--------	1	New Mexico	109	59	168
Alaska [2]	600	27	627	North Carolina	7	4	11
Arizona	68	252	320	Oregon	139	57	196
California	497	462	959	Pennsylvania [3]	--------	1	1
Colorado	195	340	535	South Carolina	1	--------	1
Georgia	1	1	2	South Dakota	83	6	89
Idaho	160	136	296	Tennessee [3]	--------	2	2
Illinois [3]	--------	2	2	Utah	9	96	105
Michigan [3]	--------	2	2	Washington	21	24	45
Missouri [3]	--------	1	1	Wyoming	7	2	9
Montana	118	243	361				
Nevada	65	271	336		2, 081	1, 988	4, 069

[1] Philippine Islands excluded.
[2] Estimate for placer mines.
[3] Number of mines contributing to production of gold and silver.

Number of mines in the United States producing gold and silver, 1927–31

Year	Placer	Lode	Total	Year	Placer	Lode	Total
1927	1, 280	2, 048	3, 328	1931	2, 081	1, 988	4, 069
1928	1, 202	1, 985	3, 187				
1929	1, 219	2, 060	3, 279	Average	1, 516	2, 013	3, 529
1930	1, 799	1, 984	3, 783				

In 1931, 286 more mines were operated than in 1930. The number of placer properties increased 282 compared with 1930. Greatly increased operations were reported in Alaska, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, South Dakota, Utah, Washington, and Wyoming. Four more lode mines were operated in 1931 than in 1930. The number of lode mines increased in Alaska, Colorado, Idaho, Montana, Nevada, North Carolina, Oregon, and South Dakota, due entirely to the operation of many small gold mines. The larger decreases were in Arizona, New Mexico, California, Wyoming, Utah, and Texas.

MINE PRODUCTION

SUMMARY

Mine production of gold and silver in the United States in 1931, by States

State	Gold		Silver		Increase or decrease from 1930	
	Fine ounces	Value	Fine ounces	Value	Gold	Silver (fine ounces)
Alabama	19. 69	$407	3	$1	−$43	------------
Alaska	459, 901. 13	9, 507, 000	352, 000	102, 080	+1, 031, 000	−56, 570
Arizona	126, 185. 94	2, 608, 495	3, 245, 311	941, 140	−893, 115	−2, 295, 421
California	523, 135. 09	10, 814, 162	867, 818	251, 667	+1, 363, 000	−754, 985
Colorado	233, 299. 75	4, 822, 734	2, 195, 914	636, 815	+305, 115	−2, 186, 938

Mine production of gold and silver in the United States in 1931, by States—Contd.

State	Gold		Silver		Increase or decrease from 1930	
	Fine ounces	Value	Fine ounces	Value	Gold	Silver (fine ounces)
Georgia	88.38	$1,827	12	$3	−$2,367	−11
Idaho	18,361.36	379,563	7,220,923	2,094,068	−63,746	−2,199,716
Illinois	----------	----------	1,300	377	----------	−497
Michigan	----------	----------	1,437	417	----------	−6,383
Missouri	----------	----------	40,000	11,600	----------	−130,210
Montana	40,112.16	829,192	3,829,837	1,110,653	−69,809	−3,223,052
Nevada	142,293.76	2,941,473	2,562,071	743,001	−139,963	−1,657,761
New Mexico	31,161.24	644,160	1,041,859	302,139	−24,996	−65,476
North Carolina	367.55	7,598	20,333	5,897	−6,984	−9,721
Oregon	15,350.10	317,315	7,254	2,104	+19,613	−1,746
Pennsylvania	251.55	5,200	2,600	754	−7,823	−3,162
Philippine Islands	182,007.70	3,762,433	97,100	28,159	+57,633	−13,178
South Carolina	22.74	470	1	----------	+470	+1
South Dakota	432,075.39	8,931,791	113,562	32,933	+513,783	+8,326
Tennessee	402.72	8,325	41,000	11,890	−6,063	−42,640
Texas	----------	----------	----------	----------	−3,648	−389,239
Utah	198,740.12	4,108,323	8,290,966	2,404,380	−200,825	−4,838,455
Vermont	----------	----------	----------	----------	----------	−4,108
Washington	2,904.19	60,035	22,410	6,499	−27,713	−10,406
Wyoming	56.36	1,165	17	5	−7,993	−105
	2,406,736.92	49,751,668	29,953,728	8,686,582	+1,835,526	−17,881,453

The preceding table gives the quantity and value of the mine production of gold and silver in 1931 by States, as reported to the Bureau of Mines by the producers, and the increase or decrease compared with 1930.

The notable increases in gold output in 1931 were in Alaska, California, Colorado, South Dakota, and the Philippine Islands—all of which recover most of their yield from siliceous ore or placers. The larger decreases in gold output were in Arizona, Idaho, Montana, Nevada, and Utah—all of which usually yield large quantities of gold from the treatment of base ores.

None of the States which regularly produce large quantities of silver showed any increase in the amount recovered in 1931, either from siliceous ore or from base ores. The decreases were especially great in Utah, Montana, Arizona, Idaho, Colorado, and Nevada—all large producers of base ores.

ORE PRODUCTION, CLASSIFICATION, AND AVERAGE VALUE

The best index of lode mining is the quantity, metallic content, and value of ore mined rather than the number of mines or operators. The next table gives the production of ore from mines producing gold and silver and the average extraction value of precious metals per ton.

The lead, zinc, and lead-zinc ores in most districts in the Eastern and Central States carry no appreciable quantity of gold or silver, and such ores are excluded from this report.

The total quantity of ore from which gold or silver was produced, sold or treated annually, decreased from 68,000,000 tons in 1918 to 21,500,000 tons in 1921, then increased steadily until 1926, when the total was 65,787,864 tons. In 1927 the total quantity was 64,526,920 tons; in 1928, 69,747,193 tons; in 1929, 75,653,924 tons, much the largest output ever recorded; in 1930, 53,972,449 tons; and in 1931, 41,985,920 tons.

Ore produced in the United States and average extraction value of gold and silver per ton in 1931, by States [1]

State	Dry and siliceous ore		Copper ore		Lead ore		Zinc ore		Copper-lead and copper-lead-zinc ores		Lead-zinc ore		Total (short tons)
	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value	
Alaska	4,195,000	$1.12	89,818	$0.63									4,284,818
Arizona	69,686	13.74	13,606,755	.18	13,951	$4.53			218	$5.10			13,690,610
California	1,008,411	6.52	473,389	.79	5,536	12.58			9,911	2.66			1,497,247
Colorado	811,619	6.03	57,232	8.12	5,410	4.58			144	14.95	162,157	$0.30	1,036,562
Georgia	300	3.50											300
Idaho	24,371	9.60	548	17.31	701,230	1.38			195,643	3.96	378,135	1.01	1,299,927
Montana	87,867	5.99	1,878,757	.71	3,031	5.20	(2)	(2)	79	15.61	50,949	.24	[2] 2,020,683
Nevada	483,157	5.09	2,936,899	.26	22,297	3.72	75		3,824	4.32	119,220	2.54	3,565,472
New Mexico	97,502	2.88	2,642,654	.04	1,982	1.18	32,875		3,347	3.32	225,581	2.34	3,003,941
North Carolina	150	5.50	63,650	.17									63,800
Oregon	7,092	12.57											7,092
Pennsylvania			[3] 488,788	[3] 2.43									488,788
South Dakota	1,404,153	6.38											1,404,153
Tennessee			510,838	.04			(4)				(4)		510,838
Utah	133,917	14.56	8,212,141	.19	140,960	6.40			79	3.32	467,520	4.53	8,954,617
Washington	5,779	10.12	5,063	.70	239	.20					80,968	.02	92,049
Wyoming	5	108.40	18	.28									23
	8,329,009	3.80	30,966,550	.23	894,636	2.39	[2] 32,950		213,245	3.91	1,484,530	2.29	[2] 41,920,920
Percentage	19.87		73.87		2.13		.08		.51		3.54		100.00
1930:													
Total	7,767,289	3.81	41,723,797	.29	1,380,641	2.85	249,366	$0.72	246,430	5.04	2,604,926	2.46	53,972,449
Percentage	14.39		77.30		2.56		.46		.46		4.83		100.00

[1] Illinois, Missouri, and Philippine Islands excluded; quantity of crude ore containing gold and silver not known.
[2] 65,000 tons of current zinc slag averaging 3 cents a ton in recovered silver, produced in Montana, not included in totals.
[3] Ore is pyritiferous magnetite yielding 2,451 tons of copper concentrates; value given is per ton of concentrates.
[4] Zinc ore and lead-zinc ore yielded no gold or silver.

Arizona led in total quantity of ore produced by about 4,736,000 tons, with 99 percent of its output copper ore; Utah ranked second, with 92 percent of its output copper ore.

The total quantity of copper ore sold or treated in 1931 decreased 10,757,247 tons, largely because of decreased production in Alaska, Arizona, California, Montana, Nevada, Tennessee, and Utah, although smaller decreases were reported in all other States but New Mexico. The quantity of lead ore (containing gold or silver) decreased 486,005 tons. All States showed decreases except Nevada, but the most important were in Idaho and Utah, whose combined output was 447,012 tons less in 1931 than in 1930. The quantity of lead-zinc ore decreased 1,120,396 tons; the largest decreases in tonnage were Colorado, 378,686; Utah, 364,352; Idaho, 285,745; Montana, 117,915; and Nevada, 38,741. The output of lead-zinc ore in Washington increased 73,768 tons and that in New Mexico 14,019 tons.

The quantity of copper-lead ore and copper-lead-zinc ore was 33,185 tons less than in 1930. The largest increases in output were in California and Idaho, and these two States produced 96 per cent of such ores treated or shipped. The largest decreases were in Nevada and Utah. The output of dry and siliceous ore increased 561,720 tons. The larger increases in tonnage were Alaska, 259,000; Arizona, 15,933; California, 277,699; Colorado, 101,128; New Mexico, 68,569; and South Dakota, 38,997. Utah, Nevada, and Texas were the only States that showed a large decrease in the output of dry and siliceous ore in 1931. Some States which showed smaller decreases were Idaho, Montana, Washington, Wyoming, and Oregon.

The value of the gold and silver recovered from 33,656,911 tons of base ores in 1931 was $13,582,081 ($10,315,469 less than in 1930), an average of about 40 cents a ton, of which about 18.5 cents represents gold. The average recovery from dry and siliceous ore in 1931 was $3.65 in gold a ton, so that 1 ton of such ore yielded about 20 times as much gold as was derived from 1 ton of ore of all other classes combined and about 27 times as much as was derived from 1 ton of copper ore. Copper ore constituted 73.87 percent of the total quantity of ores containing gold and silver in 1931.

The peak of production of dry and siliceous ore from 1906 to 1931 was reached in 1916, although the proportion of such ores to the total was largest in 1906. The extraction value of ore of this class varies greatly, depending largely on the quantity of low-grade ore milled in Alaska and South Dakota; the bulk of such ore comes from these two States. In 1931 Alaska produced 50 percent and South Dakota 17 percent of the dry and siliceous ore treated. Most of this output was milled at two properties.

Silver predominates over gold in nearly all lead ore, and mines in Utah contributed 54 percent and mines in Nevada 20 percent of the gold from lead ore in 1931. Lead-zinc ore yielded about 93 cents a ton in gold and about 4.7 ounces of silver a ton. Copper-lead ore and copper-lead-zinc ore yielded only 11 cents a ton in gold but averaged 13.1 ounces of silver a ton.

Ore produced in the United States and average extraction value of gold and silver per ton, 1927–31 [1]

Year	Dry and siliceous ore		Copper ore		Lead ore	
	Short tons	Average value	Short tons	Average value	Short tons	Average value
1927	8,549,720	$3.59	49,966,438	$0.32	2,004,729	$4.89
1928	8,094,743	3.86	55,870,147	.31	1,686,631	5.09
1929	7,671,150	3.67	62,140,833	.31	1,592,043	4.40
1930	7,767,289	3.81	41,723,797	.29	1,380,641	2.85
1931	8,329,009	3.80	30,966,550	.23	894,636	2.39

Year	Zinc ore		Copper-lead and copper-lead-zinc ores		Lead-zinc ore		Total (short tons)
	Short tons	Average value	Short tons	Average value	Short tons	Average value	
1927	452,490	$2.18	418,601	$3.07	3,134,942	$2.99	64,526,920
1928	161,311	.44	351,141	4.09	3,583,220	3.09	69,747,193
1929	494,372	1.76	259,126	6.15	3,496,400	2.84	75,653,924
1930	249,366	.72	246,430	5.04	2,604,926	2.46	53,972,449
1931	[2] 32,950	----------	213,245	3.91	1,484,530	2.29	[2] 41,920,920

[1] Illinois, Michigan, Missouri, and Philippine Islands excluded; quantity of crude ore containing gold and silver not known.

[2] Excludes 65,000 tons of current zinc slag averaging 3 cents a ton in recovered silver.

GOLD, BY SOURCES

As the following table indicates, 86.52 percent of the domestic output of gold in 1931 was obtained from dry and siliceous ores—normally gold quartz and gold-silver quartzose ores—and from placers compared with 79.86 percent in 1930. The total contribution of gold from the great copper, lead, and zinc mines of the country was only 13.48 percent compared with 20.14 percent in 1930.

Mine production of gold in the United States in 1931, by States, in fine ounces [1]

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Copper-lead and copper-lead-zinc ores	Lead-zinc ore	Total
Alabama	19.69	----------	----------	----------	----------	----------	----------	19.69
Alaska	234,231.75	225,669.38	----------	----------	----------	----------	----------	459,901.13
Arizona	1,069.23	43,025.57	80,684.64	1,384.19	----------	22.31	----------	126,185.94
California	194,503.60	312,606.62	13,607.47	1,381.74	----------	1,035.66	----------	523,135.09
Colorado	1,044.22	227,774.82	3,098.20	662.04	----------	45.49	674.98	233,299.75
Georgia	37.78	50.60	----------	----------	----------	----------	----------	88.38
Idaho	5,213.52	11,082.87	439.07	749.47	----------	2.82	873.61	18,361.36
Montana	1,907.86	24,812.48	12,905.58	262.85	----------	2.62	220.77	40,112.16
Nevada	2,883.25	100,366.09	33,807.07	3,594.24	----------	53.74	1,589.37	142,293.76
New Mexico	406.59	11,360.84	4,262.06	69.75	----------	9.30	15,052.70	31,161.24
North Carolina	85.91	39.76	241.88	----------	----------	----------	----------	367.55
Oregon	11,119.03	4,231.07	----------	----------	----------	----------	----------	15,350.10
Pennsylvania [2]	----------	----------	251.55	----------	----------	----------	----------	251.55
South Carolina	22.74	----------	----------	----------	----------	----------	----------	22.74
South Dakota	96.17	431,979.22	----------	----------	----------	----------	----------	432,075.39
Tennessee	----------	----------	402.72	----------	----------	----------	----------	402.72
Utah	37.92	75,986.70	65,018.65	9,543.71	----------	3.37	48,149.77	198,740.12
Washington	153.06	2,725.53	25.60	----------	----------	----------	----------	2,904.19
Wyoming	30.14	26.22	----------	----------	----------	----------	----------	56.36
	452,862.46	1,471,737.77	214,744.49	17,647.99	----------	1,175.31	66,561.20	2,224,729.22
Value	$9,361,498	$30,423,520	$4,439,163	$364,816	----------	$24,296	$1,375,942	$45,989,235
Percentage	20.36	66.16	9.65	.79	----------	.05	2.99	100.00
1930:								
Total	440,294.25	1,267,609.84	332,998.41	26,584.17	349.96	3,267.95	67,619.10	2,138,723.68
Value	$9,101,690	$26,203,821	$6,883,688	$549,544	$7,234	$67,554	$1,397,811	$44,211,342
Percentage	20.59	59.27	15.57	1.24	.02	.15	3.16	100.00

[1] Philippine Islands excluded. Estimated output of gold from lode mines was 180,546 ounces and from placer mines 1,462 ounces.

[2] From pyritiferous magnetite ore.

Examination of the data on domestic mine production of gold from different sources shows that the recovery from placer mines was 27 percent of the total output from 1906 to 1910, inclusive, and only 22.5 percent of that from 1921 to 1925, inclusive. In recent years placer mines yielded the following percentages of the total output of gold: 1927, 21.4; 1928, 19.4; 1929, 19.83; 1930, 20.59; and 1931, 20.36. The recovery of gold from dry and siliceous ore was 67 percent of the total output from 1911 to 1915, inclusive; it was only 55.2 percent of the total in 1927, 55.7 percent in 1928, 52.17 percent in 1929, 59.27 percent in 1930, and 66.16 percent in 1931. The domestic gold recovered from copper ore increased from about 5.8 percent of the total from 1906 to 1908, inclusive, to nearly 17.5 percent in 1927, 19.3 percent in 1928, 22.24 percent in 1929, 15.57 percent in 1930, and 9.65 percent in 1931. The recovery of gold from all other base ores was about 2.3 percent of the total from 1906 to 1910, inclusive, nearly 6 percent in 1927, 5.6 percent in 1928, 5.76 percent in 1929, 4.57 percent in 1930, and 3.83 percent in 1931.

Owing to a larger output of gold from siliceous ores and from placers the output of gold in the United States in 1932 will show an increase, notwithstanding another large decrease in the recovery of gold from base ores.

Gold produced in the United States, by sources, as reported by mines, 1922–31, in fine ounces [1]

Year	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Copper-lead and copper-lead-zinc ores	Lead-zinc ore	Total
1922–27	2,885,742	8,545,776	1,793,918	251,077	9,487	19,744	283,683	13,789,427
1928	416,832	1,195,804	414,771	35,960	130	6,973	77,594	2,148,064
1929	408,260	1,074,254	457,853	37,230	1,348	3,940	76,108	2,058,993
1930	440,294	1,267,610	332,999	26,584	350	3,268	67,619	2,138,724
1931	452,862	1,471,738	214,745	17,648	----------	1,175	66,561	2,224,729

[1] Philippine Islands and Puerto Rico excluded.

PLACERS

General features.—The output of gold from placer mines in the United States (other than 1,462 ounces, the estimated placer yield in the Philippine Islands) in 1931 was 452,862.46 ounces compared with 440,294.25 ounces in 1930. As Alaska, California, and Oregon placers produced 439,854 ounces, only about 13,008 ounces came from placers in all other States. The States showing the largest increases were California, 12,849 ounces; Idaho, 1,226 ounces; Montana, 1,187 ounces; and Nevada, 1,024 ounces. The only large decrease was 5,643 ounces in Colorado. Eighty-one percent of the placer gold was recovered by dredges; hydraulic mines recovered the next largest amount. Drift mining was important only in Alaska and California. Beach mining in California and Oregon yielded very small quantities of gold, as did dry placer mining in Arizona, California, and New Mexico.

Dredging.—The value of gold recovered by dredges in the United States, from the commercial inception of the industry in 1896 to the end of 1931, is recorded as $247,689,110, divided as follows: California, $170,625,099; Alaska, $46,669,074; Montana, $9,592,435; Colorado,

$8,276,762; Idaho, $6,235,954; Oregon, $5,654,836; and other States, $634,950. The output of gold from dredges in 1931 was $7,592,379 compared with $7,738,222 in 1930. In 1931, 58 dredges were operated and in 1930, 60. Of the total for 1931 California produced $3,619,355 from 22 dredges, Alaska $3,749,000 from 28 dredges, Idaho $80,352 from 4 dredges, Oregon $138,155 from 3 dredges, and Colorado $5,517 from 1 dredge. The recovery of gold by dredges in 1931 was the second largest since 1923.

Gold dredges operated in the United States in 1931

ALASKA

Name	Address	District	Number of dredges
Northern Star Dredging Co	Council	Council	1
Ophir Gold Dredging Co	Nome	do	1
Chatham Gold Dredging Co	Fairbanks	Fairbanks	1
Fairbanks Exploration Co	do	do	5
Fairbanks Gold Dredging Co., Ltd	do	do	2
Forsgren & Vollmer Dredging Co	Fairhaven	Fairhaven	1
Keewalik Mining Co	do	do	1
North American Dredge Co	Flat	Iditarod	1
J. E. Riley Investment Co	Iditarod	do	1
Felder-Gale & Higgins	Takotna	Innoko	2
Henry Creek Gold Dredging Co	Fairhaven	Kougarok	1
Dime Creek Dredging Co	Haycock	Koyuk	1
Dry Creek Dredging Co	Nome	Nome	1
Hammon Consolidated Gold Fields	do	do	3
McCarthy & Panos	do	do	1
Goldsmith Dredging Co	do	Solomon	1
Ruby Dredging Co	Fairbanks	do	1
Spruce Creek Dredging Co	Solomon	do	1
Beaver Dredging Co	Fairbanks	Tolovana	1
New York Alaska Gold Dredging Corporation	Candle	Tuluksak-Aniak	1

CALIFORNIA

Garden Valley Dredge	Log Cabin	Camptonville	1
Capital Dredging Co	San Francisco	Folsom	3
Milton Mining Co	Turlock	Jenny Lind	1
Madrona Dredging Co., Ltd	Lewiston	Junction City	1
LaGrange Gold Dredging Co	San Francisco	LaGrange	1
Lancha Plana Gold Dredging Co	Camanche	Lancha Plana	1
Placer Development Co., Ltd	San Francisco	Lewiston	1
Trinity Dredging Co	Lewiston	do	1
Natomas Co	Sacramento	Natoma	6
Shasta Butte Gold Dredging Co	Oroville	Oroville	1
Trautz & Green, Inc	Cottonwood	Shasta	1
Yuba Consolidated Gold Fields	San Francisco	Snelling	1
Do	do	Yuba River	3

COLORADO

Continental Dredging Co	Breckenridge	Breckenridge	1

IDAHO

Crooked River Mining Co	Nampa	Banner	1
Idaho Gold Dredging Corporation	Boise	Boise Basin	1
American Gold Dredging Corporation	do	Steele	1
Idaho Gold Dredging Co	Warren	Warren	1

OREGON

Empire Gold Dredging & Mining Co	Prairie City	Canyon	1
Rogue River Gold Co	Rogue River	Gold Hill	1
Hubbard & McCorkle, Trustees for Clark Creek Dredge (Superior).	Baker	Mormon Basin	1

Gold produced in the United States by dredges, 1927–31

Year	Dredges	California	Alaska	Other States [1]	Total
1927	59	$5,461,929	$1,740,000	$313,661	$7,515,590
1928	57	4,430,913	2,185,000	276,418	6,892,331
1929	63	3,589,259	2,932,000	310,042	6,831,301
1930	60	3,451,801	3,912,600	373,821	7,738,222
1931	58	3,619,355	3,749,000	224,024	7,592,379

[1] Colorado, Idaho, Oregon, and Washington.

Further information on this subject may be found in previous issues of Mineral Resources, in reports of the Director of the Mint, and in reports of geological surveys or mining officials of the various States.

DRY AND SILICEOUS ORES

The siliceous ore comprises free-milling (amalgamating) ore, as in Alaska, California, and Oregon; both amalgamating and concentrating ore, as in many States; concentrating ore, as in parts of Colorado and Arizona; all-sliming and cyaniding ore, as in Nevada; and smelting ore. Tailings both from old dumps and from current millings are largely reworked by concentration and subsequent cyanidation or smelting. The material smelted consists mainly of concentrates and siliceous and pyritic ores, which are also valuable as fluxes. Figures of relative output by methods and States are given on page 701.

As most of the gold produced in the United States is derived from placer gravel and dry and siliceous ores, including true gold, gold-silver, and silver ores, the following table for certain States has special interest.

Gold produced in six Western States, 1927–31

State and year	Total (lode and placer)			Gold ore				Gold-silver ore		Silver ore		Placer	
	Mines producing	Ore mined (short tons)	Gold (fine ounces)	Mines producing	Short tons	Gold (fine ounces)		Short tons	Gold (fine ounces)	Short tons	Gold (fine ounces)	Mines producing	Gold (fine ounces)
						Total	Average						
Arizona:													
1927	308	21,991,874	200,494.59	77	122,153	27,032.05	0.22	11,074	2,090.88	18,474	1,295.19	15	302.68
1928	320	22,828,766	191,927.23	74	52,089	17,844.40	.34	53,264	1,366.63	41,472	3,372.46	22	309.60
1929	412	25,860,772	202,318.14	69	68,891	14,428.87	.21	9,377	1,477.56	11,636	175.56	22	273.43
1930	342	19,802,919	169,390.38	86	48,538	33,047.09	.68	1,822	347.53	3,393	88.84	41	631.63
1931	320	13,690,610	126,185.94	158	58,862	41,032.45	.70	9,134	1,922.92	1,690	70.20	68	1,069.23
Idaho:													
1927	218	2,018,325	15,315.67	41	4,389	4,622.17	1.05	37	141.57	842	59.54	70	7,520.33
1928	207	2,054,329	20,980.38	46	10,304	11,149.07	1.08	201	37.37	66	9.40	56	8,191.63
1929	198	2,174,125	20,247.11	37	26,459	12,709.23	.48	7	81.24	117	39.59	51	4,129.92
1930	192	1,944,900	21,445.07	47	32,420	14,179.62	.44	2	2.11	837	61.05	61	3,987.45
1931	296	1,299,927	18,361.36	78	24,210	11,060.20	.46	152	18.02	9	4.65	160	5,213.52
Montana:													
1927	307	4,222,607	53,541.25	79	50,764	16,467.40	.32	170	138.94	61,042	1,782.96	60	1,079.97
1928	279	4,344,279	58,196.09	81	71,102	16,810.30	.24	207	146.14	41,022	1,535.66	43	865.14
1929	252	4,723,445	54,758.03	69	57,676	14,549.72	.25	847	540.78	43,745	1,883.50	40	596.66
1930	266	2,686,669	43,489.17	106	78,376	17,396.01	.22	371	90.00	16,801	266.32	73	720.74
1931	361	2,085,683	40,112.16	189	87,632	24,650.64	.28	86	152.30	149	9.54	118	1,907.86
Nevada:													
1927	409	5,531,152	150,346.16	158	294,308	66,615.25	.23	5,269	1,268.99	216,248	26,823.26	30	1,809.22
1928	359	7,057,433	175,157.79	142	419,043	73,223.74	.17	75,297	2,911.02	146,664	24,168.60	29	1,851.12
1929	338	7,355,500	163,711.22	118	384,381	65,742.36	.17	3,953	1,725.61	149,330	23,187.68	15	2,117.00
1930	280	4,757,178	149,064.47	132	414,023	72,690.07	.176	1,523	283.78	127,503	20,057.67	33	1,859.44
1931	336	3,565,472	142,293.76	(1)	462,887	90,131.53	.195	18,381	10,079.20	1,889	155.36	65	2,883.25
Utah:													
1927	123	15,757,074	193,908.82	7	4,226	3,390.88	.80	83,004	7,667.38	158,114	11,651.73	------	------
1928	124	18,427,117	212,559.79	8	14,704	8,700.95	.59	36,063	7,848.56	160,991	9,024.27	3	46.00
1929	130	19,831,975	240,419.63	9	25,564	20,561.46	.80	55,001	7,331.56	174,627	8,279.74	3	46.25
1930	103	11,041,841	208,455.03	16	65,200	56,292.01	.86	99,458	9,953.31	58,352	3,007.83	------	------
1931	105	8,954,617	198,740.12	28	94,769	72,056.66	.76	18,313	2,705.94	20,835	1,224.10	9	37.92
Washington:													
1927	33	119,201	19,513.51	11	43,442	19,342.06	.45	------	------	8	.14	3	18.82
1928	38	64,554	16,310.45	13	33,898	16,097.84	.47	------	------	58	.76	1	90.85
1929	33	93,527	3,719.94	5	5,120	3,220.59	.63	------	------	42	4.26	4	295.76
1930	38	45,456	4,244.81	12	7,710	3,953.14	.51	------	------	------	------	14	190.90
1931	45	92,049	2,904.19	18	5,779	2,725.53	.47	------	------	------	------	21	153.06

[1] Figures not available.

Nearly all the siliceous ore in three of the largest gold-producing States—Alaska, California, and South Dakota—yields only a small quantity of silver and is classed as gold ore. The siliceous ore from Colorado includes some silver and gold-silver ore.

Siliceous ore treated and gold recovered per ton of ore treated, 1927–31

Year	Alaska		California		South Dakota		Colorado	
	Ore treated	Recovery per ton	Ore treated	Recovery per ton	Ore treated	Recovery per ton	Ore treated	Recovery per ton
	Short tons	*Ounce*	*Short tons*	*Ounce*	*Short tons*	*Ounce*	*Short tons*	*Ounce*
1927	4,352,000	0.033	619,122	0.428	1,376,583	0.234	1,035,305	0.227
1928	3,736,500	.045	797,441	.339	1,422,138	.223	894,455	.266
1929	3,900,000	.045	573,724	.357	1,463,159	.217	640,442	.302
1930	3,936,000	.045	730,712	.344	1,365,156	.298	710,491	.274
1931	4,195,000	.054	1,008,411	.310	1,404,153	.308	811,619	.281

Alaska, California, Colorado, and South Dakota yielded 89 percent of the total dry and siliceous ore treated in 1931 and 81 percent of the total gold from such ores.

COPPER ORE

The gold obtained as a byproduct in the treatment of copper ore decreased about $2,444,500 in 1931, following a decrease of about $2,581,000 in 1930, and increases of about $890,600 in 1929 and $974,300 in 1928. No State showed any important increase of gold from copper ore in 1931. There were the following large decreases: Arizona, 51,402 ounces; California, 9,866 ounces; Montana, 8,810 ounces; Nevada, 16,277 ounces; New Mexico, 12,877 ounces; and Utah, 15,935 ounces.

LEAD ORE

The production of gold from lead ore in 1931 decreased $184,728. Arizona, California, and Nevada showed increases over 1930, but the recovery of gold from lead ore in Utah decreased 10,117 ounces. Utah mines produced 54 percent of the gold from lead ore in 1931 and 74 percent in 1930.

ZINC, LEAD-ZINC, AND MIXED ORES

No gold was reported as being derived from zinc ore in 1931, and California produced all the gold from copper-lead-zinc ore. Mines in New Mexico and Utah yielded about 95 percent of the gold from lead-zinc ore. The output of gold from all these sources was 3.04 percent of the total mine output of gold in 1931 and 3.33 percent in 1930.

SILVER, BY SOURCES

The mine production of silver in 1931 from the chief sources—copper ore, lead-zinc ore, lead ore, and siliceous ore—was 90.47 percent of the total compared with 92.58 percent in 1930. The combined output from lead and lead-zinc ores decreased from 21,820,378 ounces in 1930 to 13,070,132 ounces in 1931. The recovery from siliceous ore decreased 4,371,361 ounces and was 24,262,379 ounces less than in the record year 1922. Mines in Colorado, Nevada, and

Utah yielded 75 percent of the silver from this class of ore. The recovery of silver from copper ore decreased 4,043,915 ounces. The total recovery of silver from base bullion was about 13,498,600 ounces less in 1931 than in 1930.

Mine production of silver in the United States in 1931, by States, in fine ounces [1]

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Copper-lead and copper-lead-zinc ores	Lead-zinc ore	Total
Alabama	3							3
Alaska	28, 350	129, 800	193, 850					352, 000
Arizona	157	233, 652	2, 889, 868	119, 391		2, 243		3, 245, 311
California	13, 214	373, 567	322, 148	141, 691		17, 198		867, 818
Colorado	190	652, 539	1, 381, 995	38, 317		4, 182	118, 691	2, 195, 914
Georgia	3	9						12
Idaho	1, 848	16, 859	1, 421	3, 273, 934		2, 671, 907	1, 254, 954	7, 220, 923
Illinois [2]				1, 300				1, 300
Michigan [3]			1, 437					1, 437
Missouri				40, 000				40, 000
Montana	233	46, 876	3, 710, 564	35, 573	6, 023	4, 064	26, 504	3, 829, 837
Nevada	860	1, 323, 155	225, 355	29, 515		53, 136	930, 050	2, 562, 071
New Mexico	59	158, 257	93, 271	3, 072		37, 709	749, 491	1, 041, 859
North Carolina	21	12	20, 300					20, 333
Oregon	1, 564	5, 690						7, 254
Pennsylvania [4]			2, 600					2, 600
South Carolina	1							1
South Dakota		113, 562						113, 562
Tennessee			41, 000					41, 000
Utah	6	1, 307, 906	679, 503	2, 432, 017		662	3, 870, 872	8, 290, 966
Washington	12	7, 316	10, 322	165			4, 595	22, 410
Wyoming			17					17
	46, 521	4, 369, 200	9, 573, 651	6, 114, 975	6, 023	2, 791, 101	6, 955, 157	29, 856, 628
Value	$13, 491	$1, 267, 068	$2, 776, 359	$1, 773, 343	$1, 747	$809, 419	$2, 016, 996	$8, 658, 423
Percentage	. 16	14. 63	32. 07	20. 48	. 02	9. 35	23. 29	100. 00
1930:								
Total	44, 811	8, 740, 561	13, 617, 566	8, 778, 685	449, 983	3, 051, 604	13, 041, 693	47, 724, 903
Value	$17, 252	$3, 365, 116	$5, 242, 763	$3, 379, 794	$173, 243	$1, 174, 867	$5, 021, 052	$18, 374, 087
Percentage	. 09	18. 32	28. 53	18. 40	. 94	6. 39	27. 33	100. 00

[1] Philippine Islands excluded. Mine output of silver in Philippine Islands in 1931 was reported as 97,100 ounces, of which 160 ounces were from placer mines.

[2] From fluorspar-lead ores.

[3] Output of silver in 1931 was from lumps picked up in mines and sold to mints and refineries. No silver was recovered in 1931 from the refining of copper.

[4] From pyritiferous magnetite ore.

Silver produced in the United States, by sources, as reported by mines, 1922–31, in fine ounces [1]

Year	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Copper-lead and copper-lead-zinc ores	Lead-zinc ore	Total
1922–27	319, 794	119, 098, 946	91, 043, 944	105, 824, 049	6, 053, 353	7, 770, 018	54, 347, 284	384, 457, 388
1928	46, 276	11, 140, 496	14, 733, 852	13, 416, 657	117, 532	2, 207, 200	16, 210, 430	57, 872, 443
1929	45, 125	11, 107, 873	17, 948, 845	11, 699, 491	1, 576, 715	2, 836, 912	15, 645, 050	60, 860, 011
1930	44, 811	8, 740, 561	13, 617, 566	8, 778, 685	449, 983	3, 051, 604	13, 041, 693	47, 724, 903
1931	46, 521	4, 369, 200	9, 573, 651	6, 114, 975	6, 023	2, 791, 101	6, 955, 157	29, 856, 628

[1] Philippine Islands and Puerto Rico excluded.

PLACERS

The recovery of silver from placer bullion in 1931 was 1,710 ounces more than in 1930. Of the total output 89 percent came from Alaska and California. The fineness of placer bullion varies widely, so that operators of placer mines receive from $14 to $19 an ounce for crude gold.

DRY AND SILICEOUS ORES

Approximately 30 percent of the mine production of silver from dry and siliceous ores came from Nevada and a little less than 30 percent from Utah. The only appreciable increases in the quantity of silver from siliceous ores were in Alaska, Arizona, New Mexico, South Dakota, and Washington; the large decreases were in California, Colorado, Montana, Nevada, Texas, and Utah. About 35 percent of the silver from siliceous ore is obtained by cyanidation and amalgamation and the remainder from crude ore and concentrates smelted.

COPPER ORE

Nearly all the silver produced from copper ore is obtained in the electrolytic refining of blister copper. The yield of silver from copper ore in 1931 was about 4,043,900 ounces less than in 1930. The States showing large decreases were Arizona, 2,079,105 ounces; Montana, 873,263 ounces; California, 348,250 ounces; and Utah, 264,610 ounces. Arizona, Montana, Colorado, and Utah mines yielded about 90 percent of the total silver recovered from copper ores.

LEAD ORE

The mine production of silver from argentiferous lead ore was 2,663,710 ounces less in 1931 than in 1930. The only increase was in California. The large decreases were Arizona, 103,150 ounces; Colorado, 139,737 ounces; Idaho, 1,188,434 ounces; Missouri, 130,210 ounces; Montana, 56,062 ounces; Nevada, 118,518 ounces; New Mexico, 19,274 ounces; and Utah, 930,470 ounces. Idaho and Utah mines yielded 93 percent of the silver from lead ore in 1931.

LEAD-ZINC ORE

The output of silver from lead-zinc ore was 6,086,536 ounces less in 1931 than in 1930, and considerably more than half the silver from this source came from Utah mines. The only increases were small ones in New Mexico and Washington. The large decreases in silver derived from lead-zinc ores in 1931 were in Arizona, 142,440 ounces; Colorado, 971,709 ounces; Idaho, 1,003,170 ounces; Montana, 1,235,355 ounces; Nevada, 133,589 ounces; and Utah, 2,608,561 ounces. Lead-zinc ores in the Central and Eastern States yielded no silver.

ZINC AND MIXED ORES

The mine production of silver from zinc ores in 1931 (6,023 ounces) was all from Montana slag; the output was 443,960 ounces less than in 1930. Silver from copper-lead and copper-lead-zinc ores decreased from 3,051,604 ounces in 1930 to 2,791,101 ounces in 1931. Ninety-six percent of the output was derived from Idaho mines which yielded 35,914 ounces more in 1931 than in 1930. The largest decrease, 205,656 ounces, was from Nevada mines. The silver content of the copper-lead and copper-lead-zinc ores treated averaged 12.4 ounces a ton in 1930 and 13.1 ounces a ton in 1931.

GOLD AND SILVER, BY METHODS OF TREATMENT

The following table gives the production of gold and silver from ore, old tailings, etc., treated in 1930 and 1931:

Gold and silver produced in the United States from ore, old tailings, etc., in 1931, by States and by methods of recovery [1]

State	Total quantity of crude ore, old tailings, etc., treated (short tons)	Ore, old tailings, etc., to gold and silver mills				Ore and old tailings to concentrating mills (short tons)	Concentrates from all sources			Crude ore to smelters			Ore leached, old tailings and slag smelted, etc.		
		Ore (short tons)	Old tailings, etc. (short tons)	Gold (fine ounces)	Silver (fine ounces)		Short tons	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)
Alaska	4,284,818	4,193,699	1,284	[2] 179,539	[2] 29,675	83,012	20,575	46,085	226,325	6,823	45	67,650	--------	--------	--------
Arizona	13,690,610	49,296	550	35,840	24,851	10,084,563	530,396	29,952	934,742	1,134,886	58,608	2,252,563	[3] 9,361	717	32,998
California	1,497,247	[4] 827,809	20,035	232,398	59,806	600,657	38,612	91,010	593,720	7,691	5,216	201,077	[5] 41,055	7	1
Colorado	1,036,562	615,857	(6)	142,130	30,163	328,922	53,406	43,527	655,489	91,783	46,599	1,510,072	--------	--------	--------
Idaho	1,299,927	23,786	156	9,653	3,164	1,255,008	204,903	2,391	6,696,386	20,894	795	519,020	83	309	505
Montana	2,085,683	24,356	836	6,605	11,683	1,898,777	364,543	19,519	3,580,622	77,215	10,698	220,182	84,499	1,382	17,117
Nevada	3,565,472	174,470	275,950	84,725	1,129,643	3,036,499	151,557	37,882	1,043,719	78,527	16,780	387,782	26	24	67
New Mexico	3,003,941	3	--------	39	9	2,884,910	175,001	19,127	839,567	119,028	11,589	202,224	--------	--------	--------
Oregon	7,092	6,394	--------	3,201	739	197	28	133	2,916	501	897	2,035	--------	--------	--------
South Dakota	1,404,153	1,404,153	(7)	431,979	113,562	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Utah	8,954,617	2	3,000	165	--------	8,660,283	449,380	103,983	5,228,020	282,026	93,782	3,015,402	9,306	772	47,538
Washington	92,049	1,792	--------	646	52	86,098	11,203	41	5,959	4,159	2,064	16,387	--------	--------	--------
Wyoming	23	--------	--------	--------	--------	--------	--------	--------	--------	23	26	17	--------	--------	--------
Eastern States	[8] 1,063,726	450	--------	90	21	[9] 912,375	[9] 30,399	522	36,100	150,901	375	27,800	--------	--------	--------
	41,985,920	7,322,067	301,811	1,127,010	1,403,368	29,831,301	2,030,003	394,172	19,843,565	1,974,457	247,474	8,422,211	[10] 144,330	3,211	98,226
Total, 1930	53,972,449	6,766,859	312,272	1,014,121	2,871,386	39,989,128	2,944,120	417,316	29,990,648	3,542,620	257,732	14,109,071	[10] 221,004	9,260	529,160

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[1] Philippine Islands, Illinois, Michigan, and Missouri excluded.
[2] Exclusive of bullion from 3,230 tons of concentrates amalgamated, which is included under "Concentrates from all sources."
[3] Exclusive of 2,411,954 tons of ore leached, containing no gold or silver.
[4] Also 7,809 tons of concentrates from California were cyanided and yielded 34,540 ounces of gold and 27,744 ounces of silver. The figures are included under "Concentrates from all sources."
[5] Includes 41,053 tons of pyrites roasted for the manufacture of sulphuric acid; residue leached amounted to 29,335 tons.
[6] Sands and slimes (264,191 tons) from ore first treated by amalgamation were cyanided.
[7] Sands and slimes (1,400,191 tons) from ore first treated by amalgamation were cyanided.
[8] Includes low-grade pyritiferous magnetite ore from Pennsylvania; excludes ore containing no gold or silver.
[9] Includes only ore or concentrates yielding gold and silver.
[10] Exclusive of ore leached, containing no gold or silver, as follows: 1931, 2,411,954 tons; 1930, 3,140,566 tons.

Many gold and silver mills employ concentrating apparatus, and the concentrates obtained are combined in the preceding table with those from straight concentrating mills under the heading "Concentrates from all sources." The gold and silver included in this item are recovered partly by amalgamation (particularly in Alaska and California) and cyanidation, although most of the concentrates are smelted.

The figures for the quantity of ore treated by concentration include the large quantities of copper, lead, zinc, and mixed ores whose concentrates are smelted primarily for these metals, the gold and silver being recovered in refining the copper and lead bullion and smelting the zinc residues. The quantity of concentrates produced and the recoverable gold and silver content represent not only the concentrates from these straight concentrating mills but also the comparatively small quantity from gold and silver mills.

There was a large increase in 1931 in gold recovered at gold and silver mills, but the quantity of silver recovered at such mills decreased more than half. Gold recovered at gold and silver mills increased considerably in Alaska, Arizona, California, Montana, Nevada, Oregon, South Dakota, and Utah and decreased in Colorado, Idaho, Washington, and Wyoming. The States showing the largest decreases in silver recovered at mills in 1931 were Colorado, Nevada, and Texas; the only increases were in Alaska, California, Montana, and South Dakota.

Of the total quantity (29,831,301 tons) of ore containing gold and silver sent direct to concentrating plants in the United States in 1931, Arizona and Utah contributed 63 percent. A large part of the decrease in the quantity of ore concentrated in 1931 was caused by the much smaller quantity of copper ore concentrated in these two States and in Nevada and California. The decrease in quantity of ore concentrated in Colorado and Idaho was due largely to the smaller quantity of lead ore and lead-zinc ore treated. Of the total gold recovered from concentrates, nearly half came from Utah and California. Of the silver from concentrates, 34 percent came from Idaho, 26 percent from Utah, and 18 percent from Montana. The only States that showed large increases in the quantity of ore directly concentrated in 1931 were New Mexico and Washington, and these increases were due to the larger quantity of lead-zinc ore concentrated at one mine in each State.

In 1919 about 5.6 tons of crude ore were treated at concentrating plants for every ton of crude ore sent direct to smelters. In 1931 about 15.1 tons of crude ore were concentrated for every ton of crude ore shipped direct to smelters.

In 1931 Arizona produced 57.5 percent of the ore directly smelted, and Arizona, Utah, and Colorado produced more than 80 percent of the gold and 80.5 percent of the silver recovered from crude ores smelted. The quantity of crude ore smelted in 1931 was only about 6.6 percent of that of crude ore concentrated. Only Washington increased shipments of crude ore direct to smelters in 1931. The largest decreases were Arizona, 927,954 tons; Nevada, 143,066 tons; and Utah, 169,491 tons. Other substantial decreases were in California, Colorado, Idaho, and New Mexico.

Most of the ore leached and old slag, etc., (which contained gold and silver) treated in 1931 came from California and Montana; also 2,411,954 tons of ore which did not yield any gold or silver were leached in Arizona in 1931.

The old materials, mainly tailings and slag, re-treated (with which are included figures for ore and old tailings leached) are partly smelted, often for their fluxing as well as their metal value. Most of the gold and silver derived from old tailings is included under recoveries by amalgamation and cyanidation at gold and silver mills.

Gold and silver produced at mills in the United States and percentage of gold and silver recovered by smelting and from placers, 1927–31 [1]

Year	Ore, old tailings, etc., treated (short tons)	Bullion recovered from all sources (fine ounces)				Percentage of gold and silver from all sources							
		Amalgamation		Cyanidation		Amalgamation		Cyanidation		Placers		Smelting [2]	
		Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1927	7,741,562	649,044	195,895	377,833	4,177,848	30.8	0.3	17.9	7.0	21.4	0.1	29.9	92.6
1928	7,242,870	675,222	211,633	374,900	4,256,989	31.4	.4	17.5	7.4	19.4	.1	31.7	92.1
1929	6,907,140	619,776	218,642	324,819	3,229,206	30.1	.4	15.8	5.3	19.8	.1	34.3	94.2
1930	7,079,131	700,318	230,406	380,148	2,728,841	33.2	.5	17.8	5.7	20.6	.1	28.4	93.7
1931	7,623,878	806,317	274,850	396,390	1,254,866	36.2	.9	17.8	4.2	20.4	.2	25.6	94.7

[1] Philippine Islands excluded.
[2] Both crude ores and concentrates.

Gold and silver bullion produced at mills in the United States in 1931, by States [1]

State	Ore, old tailings, etc., treated (short tons)	Bullion recovered from all sources (fine ounces)				Percentage of gold and silver from all sources in State			
		Amalgamation		Cyanidation		Amalgamation		Cyanidation	
		Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Alaska	4,194,983	[2] 218,236	[2] 127,954	2,460	325	47.5	36.4	0.5	0.1
Arizona	49,846	1,936	1,217	33,904	23,634	1.53	.04	26.9	.7
California	847,844	213,514	45,750	[3] 53,424	[3] 41,800	40.8	5.3	10.2	4.8
Colorado	[4] 615,857	52,373	9,524	89,757	20,639	22.4	.4	38.5	.9
Idaho	23,942	9,635	2,259	18	905	52.5	.03	.1	.01
Montana	25,192	1,787	773	4,818	10,910	4.5	.02	12.0	.3
Nevada	450,420	16,686	18,695	68,039	1,110,948	11.7	.7	47.8	43.4
New Mexico	3	39	9	----------	----------	.1	------	------	------
Oregon	6,394	3,201	739	----------	----------	20.9	10.2	------	------
South Dakota	[5] 1,404,153	288,156	67,857	143,823	45,705	66.7	59.8	33.3	40.2
Utah	3,002	18	----------	147	----------	.01	------	.07	------
Washington	1,792	646	52	----------	----------	22.2	.23	------	------
Eastern States	450	90	21	----------	----------	7.8	.03	------	------
	7,623,878	806,317	274,850	396,390	1,254,866	36.2	.9	17.8	4.2
Value	----------	$16,668,052	$79,707	$8,194,109	$363,911	------	------	------	------
1930:									
Total	7,079,131	700,318	230,406	380,148	2,728,841	33.2	.5	17.8	5.7
Value	----------	$14,476,858	$88,706	$7,858,357	$1,050,604	------	------	------	------

[1] Philippine Islands excluded.
[2] Includes bullion from 3,230 tons of concentrates amalgamated.
[3] Includes bullion from 7,809 tons of concentrates cyanided. Concentrates came from 343,348 tons of ore first amalgamated or cyanided.
[4] Also 264,191 tons of sands and slimes from ore first treated by amalgamation were cyanided; 6 tons of concentrates were also cyanided.
[5] Also 1,400,191 tons of sands and slimes from ore first treated by amalgamation were cyanided.

About 20.4 percent of the total gold output in 1931 came from placers, which also yielded a very small quantity of silver. The quantity of gold recovered by cyanidation increased 16,242 ounces, and the following States showed large increases in output: Alaska, 2,023 ounces; Arizona, 5,217 ounces; California, 10,312 ounces; Montana, 4,743 ounces; and South Dakota, 7,097 ounces. The large decreases were in Colorado (7,241 ounces) and Nevada (5,908 ounces).

The gold recovered by amalgamation increased 105,999 ounces, the large increases being in Alaska (42,923 ounces), California (39,999 ounces), Colorado (2,575 ounces), Montana (527 ounces), Nevada (7,085 ounces), and South Dakota (17,708 ounces). The only large decreases were in Idaho (2,980 ounces), Washington (2,814 ounces), and Wyoming (395 ounces). There was no abnormal change in 1931 in the small quantity of silver recovered by amalgamation.

The total yield of gold by amalgamation was 806,317 ounces in 1931 compared with a recorded output of 1,120,344 ounces in 1911, the first year for which figures are available. The quantity of gold recovered by cyanidation was 396,390 ounces in 1931 compared with 1,444,077 ounces in 1915, the year of largest recorded output. These figures show that the quantity of gold recovered by cyanidation has decreased at a much higher rate than that recovered by amalgamation. The quantity of silver (1,254,866 ounces) recovered by cyanidation in 1931 was the smallest from this source for many years and was only about 12.5 percent of that recovered in 1923.

In 1931 amalgamation produced gold and silver valued together at $16,747,759 compared with $8,558,020 produced by cyanidation.

No figures are available showing the total quantity of quicksilver and cyanide used at gold and silver mills in the United States in 1931. Considerable cyanide is used at flotation mills, as well as at gold and silver mills. Large quantities of quicksilver are used at gold dredges in Alaska, California, Colorado, Idaho, and Oregon, and also at other placer mines. The following quantities of quicksilver were purchased for use in the States for which figures are available: Arizona, 30 pounds; California, 18,912 pounds; Colorado, 1,624 pounds; Idaho, 19 pounds; Montana, 29 pounds; Nevada, 723 pounds; South Dakota, 15,305 pounds; and Washington, 2 pounds.

REVIEW BY STATES

ALASKA

Gold.—The total estimated production of gold from Alaska mines from 1880 to 1931, inclusive, is given by the United States Geological Survey as $398,824,000. The mine production in 1931 was $9,507,000, $1,031,000 more than in 1930. The yield from lode mines increased $1,026,000 and that from placer mines $5,000. The 28 dredges operated in 1931 produced $3,749,000 compared with $3,912,600 from 27 in 1930. The average recovery of gold by the dredges in 1931 was 36.7 cents a cubic yard of gravel. The total recovery by gold dredges from 1903 to 1931, inclusive, is $46,669,074. The siliceous ore treated in 1931 (4,195,000 tons) yielded an average of $1.12 in gold and silver to the ton.

Silver.—The mine production of silver in Alaska in 1931 was 352,000 ounces, 56,570 less than in 1930. In 1931 copper ore yielded

193,850 ounces, siliceous ore 129,800 ounces, and placer bullion 28,350 ounces. The decrease in silver was due entirely to a smaller production of copper.

ARIZONA

Gold.—The mine production of gold from Arizona in 1931 was $2,608,495, of which $22,103 was from placer mines. Copper ores yielded $1,667,900 of the production from lode mines, dry and siliceous ore $889,417, lead ore $28,614, and copper-lead ore $461. The output of gold from siliceous ore in 1931, chiefly from Mohave County, increased $197,253. Gold in bullion from ores treated by amalgamation amounted to 1,936 ounces and from those treated by cyanidation to 33,904 ounces. The gold recovered from concentrates was 29,952 ounces and that frcm crude ore smelted 58,608 ounces, both much less than the recoveries in 1930.

Silver.—The mine production of silver in Arizona in 1931 (3,245,311 ounces) was 2,295,421 ounces less than in 1930. The sources of the output of silver were: Copper ore, 2,889,868 ounces; siliceous ore, 233,652 ounces; lead ore, 119,391 ounces; copper-lead ore, 2,243 ounces; and placer bullion, 157 ounces. Most (2,252,563 ounces) of the silver was recovered from crude ore smelted. Concentrates treated yielded 934,742 ounces, and mill bullion contained 24,851 ounces.

ARKANSAS, MISSOURI, OKLAHOMA, ILLINOIS, AND KENTUCKY

The lead, zinc, and lead-zinc mines of the Central States do not report any recovery of gold, and only a few report any silver. No zinc ores in the Central States yield any silver, and no silver is recovered from lead or zinc concentrates. The copper ore of southeastern Missouri contains some silver, but no copper ore has been shipped for several years. All the silver from southeastern Missouri in 1931 (40,000 ounces) was obtained from residues of zinc concentrates derived from lead ores. These residues are shipped to lead smelters after treatment at zinc smelters. The lead-fluorspar deposits of the Illinois-Kentucky region carry silver, and 1,300 ounces of silver were recovered from lead concentrates shipped from Illinois in 1931.

CALIFORNIA

Gold.—The total production of gold from California mines from 1848 to 1931, inclusive, is recorded as $1,852,354,387, of which $1,238,561,900 was from placer mines. In 1931 the lode mines produced $6,793,416 (an increase of $1,097,397), of which gold quartz yielded nearly 95 percent; placers yielded $4,020,746 (an increase of $265,603). Of the placer production of gold $3,619,355 was recovered by 22 gold dredges. The total gold produced by dredging from 1896 to 1931, inclusive, was $170,625,099. Only three counties had a gold production in 1931 exceeding $1,000,000; these were, in order of output, Nevada, Sacramento, and Amador. The five Mother Lode counties—Amador, Calaveras, Eldorado, Mariposa, and Tuolumne—whose output is mainly gold milling ore, produced from that source 83,126 fine ounces of gold in 1931 and 91,673 ounces in 1930.

Silver.—The total silver production of California from 1848 to 1931, inclusive, is recorded as 85,404,568 fine ounces. The silver produced in 1931 (867,818 ounces) was 754,985 ounces less than in 1930. The

1931 output of silver was derived from the following sources: Placer bullion, 13,214 ounces; dry and siliceous ore, 373,567 ounces; copper ore, 322,148 ounces; lead ore, 141,691 ounces; and copper-lead-zinc ore 17,198 ounces. Most of the silver was from mines in Inyo, Napa, Nevada, Plumas, and San Bernardino Counties, and only three mines yielded more than 100,000 ounces each.

COLORADO

The total production of gold from Colorado mines from 1858 to 1931, inclusive, is recorded as $720,301,766 and that of silver as 660,127,833 fine ounces.

Gold.—The mine production of gold in Colorado in 1931 ($4,822,734) was $305,115 more than in 1930. The Cripple Creek district in Teller County produced $2,385,769; the San Juan region, $909,141; and mines in Park County, $871,789. Gold recovered at lode mines was valued at $4,801,148 and that from placers at $21,586. Dry and siliceous ore yielded 97.6 percent of the total output. The quantity of gold recovered by amalgamation and cyanidation was 142,130 ounces, that contained in concentrates 43,527 ounces, and that in crude ore shipped to smelters 46,599 ounces.

Silver.—The output of silver from Colorado mines in 1931 was 2,195,914 ounces (2,186,938 ounces less than in 1930). Of this output mines in Eagle County contributed 1,497,131 ounces and mines in San Juan County 430,793 ounces. Dry and siliceous ore yielded 652,539 ounces, copper ore 1,381,995 ounces, lead ore 38,317 ounces, lead-zinc ore 118,691 ounces, copper-lead ore 4,182 ounces, and placer bullion 190 ounces. Only 30,163 ounces of silver were recovered in bullion at gold mills; 1,510,072 ounces came from crude ore shipped to smelters; and silver derived from concentrates amounted to 655,489 ounces.

IDAHO

The total production of gold in Idaho from 1863 to 1931, inclusive, is estimated at $137,889,762 and that of silver for the same period at 333,668,941 ounces.

Gold.—Of the total output of gold in Idaho in 1931 ($379,563) the placer mines yielded $107,773 and the lode mines $271,790. Of the placer gold $80,352 was recovered by four dredges. The total value of the gold recovered by dredges from 1897 to 1931, inclusive, was $6,235,954. Dry and siliceous ore yielded $229,104 in gold, lead-zinc ore $18,059, lead ore $15,493, and copper ore $9,076. Gold and silver mills recovered 9,635 ounces of gold by amalgamation and only 18 ounces by cyanidation.

Silver.—Of the 1931 output of silver (7,220,923 ounces) 7,003,541 ounces were from the Cœur d'Alene region in Shoshone County. Lead ore yielded 3,273,934 ounces, lead-zinc ore 1,254,954 ounces, copper-lead ore 2,671,907 ounces, siliceous ore 16,859 ounces, copper ore 1,421 ounces, and placer bullion 1,848 ounces. Concentrates shipped yielded 6,696,386 ounces and crude ore shipped to smelters 519,020 ounces. Only 5,012 ounces were obtained from mill and placer bullion.

MICHIGAN

Apparently no copper bullion was refined in 1931, so that the only production of silver was 1,437 fine ounces contained in lumps of native silver sold to refineries.

MONTANA

The total production of gold from Montana from 1904 to 1931, inclusive, is recorded as $77,638,027 and the total silver production for the same period as 335,993,311 ounces.

Gold.—The total gold from mines in Montana in 1931 was $829,192, a decrease of $69,809 from 1930. The gold recovered from placer mines was $39,439, an increase of $24,540. The output of gold from lode mines ($789,753) was a decrease of $94,349. The lode gold was recovered mainly from siliceous ore, which yielded $512,919; copper ore yielded $266,782; and all other classes of ore combined $10,052. At amalgamation and cyanidation plants 6,605 ounces of gold were recovered. Concentrates from all sources yielded 19,519 ounces of gold and crude ore shipped to smelters 10,698 ounces.

Silver.—The total production of silver from Montana mines in 1931 (3,829,837 ounces) was 3,223,052 ounces less than in 1930. Copper ore yielded 3,710,564 ounces (873,263 less than in 1930), lead-zinc ore, 26,504 ounces; siliceous ore, 46,876 ounces; zinc ore (slag), 6,023 ounces; copper-lead ore, 4,064 ounces; and placer bullion, 233 ounces. Bullion from gold mills yielded only 11,683 ounces of silver; concentrates, mainly copper and lead, 3,580,622 ounces; and crude smelting ore, 220,182 ounces. The 364,543 tons of concentrates smelted in 1931 yielded an average of 9.8 ounces of silver a ton.

NEVADA

The total production of gold in Nevada from 1904 to 1931, inclusive, is recorded as $215,234,386 and the total production of silver as 252,778,753 ounces.

Gold.—The mine production of gold in Nevada in 1931 was $2,941,473, $139,963 less than in 1930. The placer mines produced only $59,602. The larger producing counties were White Pine, with $781,998; Elko, with $546,521; and Nye, with $682,246. The total gold derived from siliceous ore was $2,074,752 and that from copper ore $698,854; the gold from all other classes of ore was $108,265.

Silver.—The mine production of silver in Nevada in 1931 (2,562,071 ounces) was 1,657,761 ounces less than in 1930. Mines in Nye County yielded 1,352,509 ounces and those in Lincoln County 467,218 ounces. Dry and siliceous ores yielded 1,323,155 ounces, lead-zinc ore 930,050 ounces, copper ore 225,355 ounces, lead ore 29,515 ounces, copper-lead ore 53,136 ounces, and placer bullion 860 ounces. About 1,110,900 ounces of silver were recovered at cyanide plants, 387,782 ounces from crude ore smelted, and 1,043,719 ounces from concentrates treated.

NEW MEXICO

Gold.—The gold produced by mines in New Mexico in 1931 ($644,160) was $24,996 less than in 1930. The gold output of San Miguel County was $308,831, mostly derived from concentrates recovered from lead-zinc ore. Copper ore yielded 4,262 ounces of gold, lead-zinc ore 15,053 ounces, dry and siliceous ore 11,361 ounces, lead ore 70 ounces, and placers 407 ounces. Concentrates of all kinds yielded 19,127 ounces of gold and crude ore shipped to smelters 11,589 ounces.

Silver.—The mine output of silver decreased from 1,107,335 ounces in 1930 to 1,041,859 ounces in 1931. Grant, San Miguel, and Hidalgo Counties were the only counties that had an output of more than 100,000 ounces. Siliceous ore yielded 158,257 ounces, copper ore 93,271 ounces, lead-zinc ore 749,491 ounces, copper-lead ore 37,709 ounces, lead ore 3,072 ounces, and placer bullion 59 ounces. Concentrates yielded 839,567 ounces and crude ore shipped to smelters 202,224 ounces.

OREGON

Gold.—The production of gold from mines in Oregon in 1931 was $317,315, $19,613 more than in 1930. The ouput from lode mines was $87,464, an increase of $4,181 over that in 1930. The placer mines produced $229,851, of which dredges in Baker, Grant, and Jackson Counties yielded $138,155. Lode and placer mines in western Oregon yielded $189,005 in gold and those in eastern Oregon $128,310.

Silver.—Of the total output of silver in 1931 (7,254 ounces), 5,690 ounces came from dry and siliceous ore and 1,564 ounces from placer bullion.

SOUTH DAKOTA

The total gold produced in South Dakota from 1875 to 1931, inclusive, is recorded as $298,155,522 and the total output of silver for the same period as 7,883,626 ounces.

Gold.—The mine production of gold in South Dakota in 1931 was $8,931,791, or $513,783 more than in 1930. Almost all the gold was from siliceous ore, mainly from the Homestake mine. The mills at this property recovered gold-silver bullion valued at $8,935,307 in 1931. From 1876 to 1931, inclusive, the Homestake property recovered bullion valued at $243,482,631. Only 96 ounces of gold were recovered from placers.

Silver.—The output of silver from South Dakota mines in 1931 was 113,562 ounces, all derived from dry and siliceous ore.

SOUTHERN APPALACHIAN AND EASTERN STATES

Gold.—The total production of gold in the Southern Appalachian States from 1799 to 1931, inclusive, is recorded as $51,223,004; this is credited to the seven States as follows: Alabama, $767,806; Georgia, $17,853,679; Maryland, $71,405; North Carolina, $23,690,687; South Carolina, $5,183,285; Tennessee, $357,706; and Virginia, $3,298,436. The mine output of gold in the Eastern and Southern Appalachian States decreased from $46,637 in 1930 to $23,827 in 1931. Gold was produced in the following States in 1931: Alabama, $407; Georgia,

$1,827; North Carolina, $7,598; Pennsylvania, $5,200; South Carolina, $470; and Tennessee, $8,325. Small placers in Alabama, Georgia, North Carolina, and South Carolina yielded 166 ounces of gold, siliceous ores milled in Georgia and North Carolina 90 ounces, copper ore from North Carolina and Tennessee 645 ounces, and pyritiferous magnetite ore from Pennsylvania about 252 ounces.

Silver.—Siliceous ore and placer bullion yielded only 49 ounces of silver in 1931. Copper ore from Tennessee and North Carolina yielded 61,300 ounces and copper concentrates derived from pyritiferous magnetite ore mined in Pennsylvania 2,600 ounces (about 1 ounce to a ton of concentrates.

TEXAS

The total output of gold from mines in Texas from 1885 to 1931, inclusive, is recorded as $95,073 and the output of silver for the same period as 22,772,523 ounces. The Presidio mine and mill were idle in 1931, and no shipments of ore or concentrates were made from any mines in Texas during the year.

UTAH

The total output of gold from Utah mines from 1864 to 1931, inclusive, is recorded as $139,657,325 and the total output of silver for the same period as 585,475,176 ounces.

Gold.—In 1931 the mine production of gold (all but $784 from lode mines) was $4,108,323, a decrease of $200,825 from 1930. Copper ore yielded nearly 65,019 ounces; dry and siliceous ore, 75,987 ounces; lead-zinc ore, 48,150 ounces; lead ore, 9,544 ounces; and copper-lead ore, 3 ounces. Concentrates shipped yielded 103,983 ounces and crude smelting ore 93,782 ounces; only 165 ounces of gold were recovered at gold and silver mills.

Silver.—The mine production of silver in Utah decreased from 13,129,421 ounces in 1930 to 8,290,966 ounces in 1931. Mines in the Tintic district yielded 3,286,748 ounces, those in the Bingham district 2,502,057 ounces, and those in the Park City region 2,124,177 ounces. Lead-zinc ore supplied 3,870,872 ounces, lead ore 2,432,017 ounces, dry and siliceous ore 1,307,906 ounces, copper ore 679,503 ounces, and copper-lead ore 662 ounces. Crude ore shipped to smelters yielded 3,015,402 ounces, concentrates 5,228,020 ounces, and other material including old tailings smelted 47,538 ounces.

WASHINGTON

The total production of gold from Washington mines from 1860 to the end of 1931 is recorded as $30,482,780 and that of silver for the same period as 9,307,090 ounces.

Gold.—The mine production of gold in Washington decreased from $87,748 in 1930 to $60,035 in 1931. Some of the mines in the Republic district idle in 1930 were active in 1931. The district shipped most of the output. Small placer mines produced $3,164 and copper ore $529; the remainder ($56,342) was from siliceous ore, most of which was shipped to smelters.

Silver.—The output of silver from Washington mines decreased from 32,816 ounces in 1930 to 22,410 ounces in 1931 which was the smallest silver production since 1894. The sources of the silver were: Copper ore, 10,322 ounces; lead ore, 165 ounces; siliceous ore, 7,316 ounces; lead-zinc ore, 4,595 ounces; and placer bullion, 12 ounces. Crude ore shipped to smelters supplied 16,387 ounces, concentrates 5,959 ounces, and amalgamation 52 ounces.

WYOMING

The total production of gold from mines in Wyoming from 1867 to 1931, inclusive, is recorded as $1,250,819 and that of silver for the same period as 70,336 ounces.

Gold.—The mine production of gold from Wyoming mines decreased from 443 ounces in 1930 to 56 ounces in 1931. About 26 ounces were derived from gold ore and the remainder from small placer mines.

Silver.—The silver output of Wyoming in 1931 was only 17 ounces, recovered from copper ore shipped to smelters.

PHILIPPINE ISLANDS[8]

Gold.—The output of gold in the Philippine Islands from 1907 to 1931, inclusive, is recorded as $36,062,428. The production during the past 10 years follows:

1922	$1, 526, 400	1927	$1, 686, 231
1923	1, 686, 327	1928	1, 904, 062
1924	1, 651, 796	1929	3, 320, 300
1925	1, 945, 990	1930	3, 704, 800
1926	1, 925, 188	1931	3, 762, 433

The lode mines yielded 180,546 ounces of gold from siliceous ore in 1931 and the small placer mines 1,462 ounces. No base ores were treated, and the entire output of silver (97,100 ounces) was from bullion recovered at mills (except 160 ounces from placers). The Baguio district in Mountain Province has been the largest producer of gold since 1921. The three large producing properties are the Benguet, Balatoc, and Itogon.

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[8] A list of the publications of the Bureau of Science, Manila, P.I., relating to the various districts is given on page 857 of the 1930 chapter of this series.

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